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IDENTIFIERS *Direct Current: Mountain Plains Program

ABSTRACT

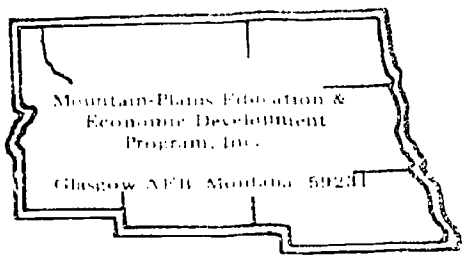
One of four individualized courses included in a radio and television repair curriculum, this course deals with the basic electrical properties of current, voltage, resistance, magnetism, mutual induction, and capacitance. The course is comprised of ten units: (1) Current, (2) Voltage, (3) Resistance, (4) Measuring Voltage and Current in Series Circuits, (5) Relationships of Current, Voltage, and Resistance, (6) Parallel Circuits, (7) Series-Parallel Circuits, (8) Magnetism and Electromagnetics, (9) Mutual Induction and RL Circuits, and (10) Capacitance. Each unit begins with a Unit Learning Experience Guide that gives directions for unit completion. The remainder of each unit consists of Learning Activity Packages (LAP) that provide specific information for completion of a learning activity. Each LAP is comprised of the following parts: objective, evaluation procedure, resources, procedure, supplemental sheets, study guide, and a LAP test with answers. The course is preceded by a pretest which is designed to direct the student to units and performance activities. (LRA)

MOUNTAIN PLAINS LEARNING EXPERIENCE GUIDE:
Radio and T.V. Repair.

Course: D.C. Circuits.

File Code: 77.01.00.00.A2-1

Date Published: 9/10/75



Learning Experience Guide

COURSE: D.C. CIRCUITS

DESCRIPTION:

Direct current (DC) circuits deals with the basic electrical properties of current, voltage, resistance, magnetism, mutual induction and capacitance. The inter-relationships of these properties are explored for various series, parallel and series-parallel circuits. Background theory and experimental practice is provided.

RATIONALE:

Knowledge about electrical/electronic fundamental concepts, principles and procedures are required for a person to be successful in an electrical/electronic service occupation. Basic electrical theory is important for the person that plans to diagnose problems or make tests of electrical/electronic circuits. These are circuits that function with direct current applications.

OBJECTIVES:

Given a student handbook, a student unit booklet, equipment and work station facilities, complete exercises and experiments that enable you to identify and explain characteristics of electricity.

Mathematically determine and measure with equipment, current, resistance, power and voltage and their effect in direct current circuits.

PREREQUISITES:

Must be able to discriminate all colors.
Capable of using basic algebra.

RESOURCES:

A resource list is attached.

GENERAL INSTRUCTIONS:

This course has ten units. Each unit has a Unit Learning Experience Guide (LEG) that gives directions for unit completion. Each unit consists of Learning Activity Packages (LAPs) that provide specific information for completion of a learning activity. Pretesting results direct the student to units and performance activities

The general procedure for this course is as follows:

1. Read the assigned unit LEG for this course.
2. Begin and complete the first assigned LAP.
3. Proceed to the next assigned LAP in the unit.
4. Complete all required LAPs for the unit by following steps 2 through 4.
5. Take the unit tests as described in the Unit LEG "Evaluation Procedures".

6. Proceed to the next assigned unit in this course.
7. Follow steps 1 through 7 for all required units for this course.
8. Proceed to the next assigned course.

You will work independently unless directed to do otherwise. When questions or problems arise, you are expected to discuss them with the instructor. At all times remember to follow correct safety procedures during the performance activity.

UNIT TITLES:

.01 Current
.02 Voltage
.03 Resistance
.04 Measuring Voltage and Current in Series Circuits
.05 Relationships of Current, Voltage and Resistance
.06 Parallel Circuits
.07 Series-Parallel Circuits
.08 Magnetism and Electromagnetics
.09 Mutual Induction and RL Circuits
.10 Capacitance

EVALUATION PROCEDURE:

Course evaluation of the student is by pre and post testing using a multiple-choice type of test.

In this course, the course test is used as a pretest to determine which units, if any, the student may be able to validate. For each unit on the course pretest that the student correctly completes 4 out of 5 items, for each LAP part, the student is considered validated.

The course test will also be taken by the student as a post test to determine any changes resulting from taking all or part of the course.

FOLLOW-THROUGH:

If the information in this guide is clear to you, go to the first assigned Unit Learning Experience Guide (LEG).

If you have a question, ask your instructor for help.

RESOURCE LIST BY COURSE FOR

CURRICULUM AREA 77: RADIO & TELEVISION SERVICEMAN

DC Circuits 77.01

Printed Materials

1. DC Circuits, An Individualized Approach to Electronics, (set of ten booklets, student handbook, and progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

Audio/Visual

none

Equipment

1. Electricity/Electronics, "C" Case-Combination Learning Unit - portable, Model BG850A/C, Brodhead-Garrett, Sacramento, California.
2. Regulated power supply.
3. Stop watch.
4. Vacuum tube volt meter.
5. Volt-ohmmeter.

9/10/75

Student: _____ File Code: 77.01.00.00.A2-2

Date: _____ Date Published: 10-8-74

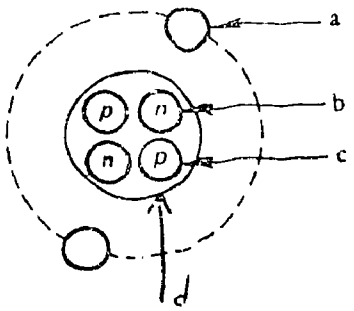
Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

COURSE POST TEST: D.C. CIRCUITS

77.01.01.01

1. Electrical movement is theoretical because:
   (A) electrical movement is only hearsay
   (B) the effects of electricity are unpredictable
   (C) the existence of electricity is not positively known
   (D) electrical movement or flow cannot be directly observed

2. Which element is the electron in the diagram below?
   (A) a
   (B) b
   (C) c
   (D) d



3. If a neutral atom contains 10 protons and 14 neutrons, it should contain:
   (A) 4 electrons
   (B) 24 electrons
   (C) 14 electrons
   (D) 10 electrons

4. The nucleus of an atom is:

   (A) composed of electrons and neutrons.
   (B) the lightest part of the atom.
   (C) at the center of the atom.
   (D) at the outside of the atom.

5. In any atom:

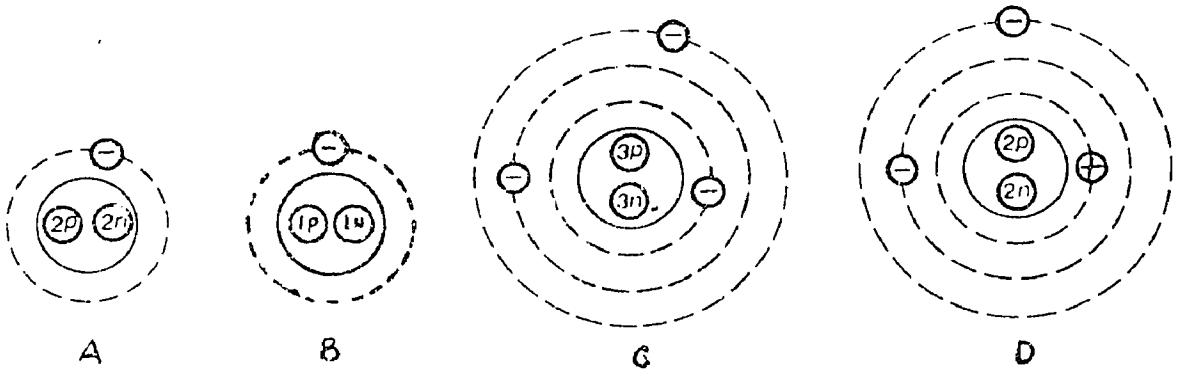
   (A) the neutron orbits the proton and the electron.
   (B) the electron orbits the nucleus.
   (C) the proton orbits the nucleus.
   (D) the neutron orbits the electron.

77.01.01.02

6. In a diagram of an atom, the electron would be shown as which of the following?
(A) ____ 
(B) ____ 
(C) ____ 
(D) ____ 

7. When an electron is removed from a neutral atom, the atom becomes:
(A) a negative ion
(B) a positive ion
(C) an unchanged ion
(D) a free ion

8. Which of the following diagrams represent an ion atom?
(A) ____
(B) ____
(C) ____
(D) ____



A B C D

9. Coulomb's law of charged bodies states that:
(A) unlike charges repel, like charges attract
(B) unlike charges attract, like charges repel
(C) both unlike and like charges act act
(D) both unlike and like charges repel

10. Coulomb's law is concerned with attraction or repulsion between charged bodies. It therefore applies to:
(A) free or captive electrons
(B) neutrons
(C) ions
(D) nucleus

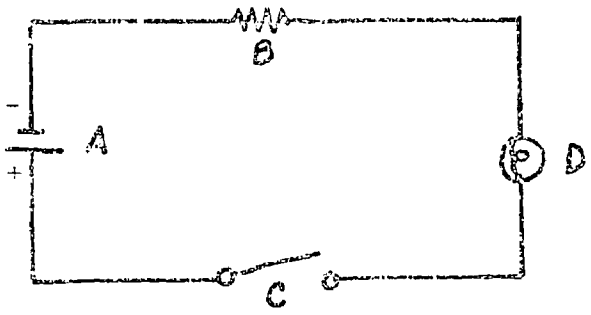
77.01.01.03

11. Check the phrase that correctly describes electron current flow:
(A) the drifting of outermost electrons away from their atomic nuclei
(B) the directed drift of positive and negative charges through a wire
(C) free electrons moving in one direction
(D) the random drift of electrons in a conductor

77.01.01.C (continued)

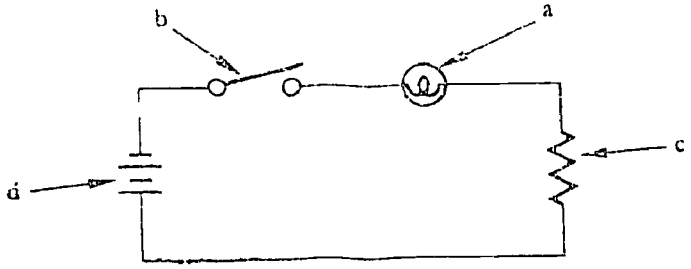
12. In the schematic shown identify the symbol that represents the battery.

(A) _____
(B) _____
(C) _____
(D) _____



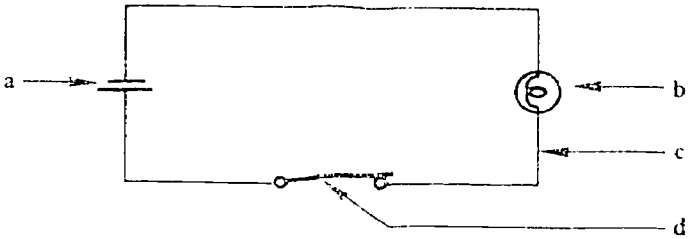
13. What is the name of the component indicated by the letter "a" in the diagram below?

(A) battery
(B) switch
(C) resistor
(D) lamp



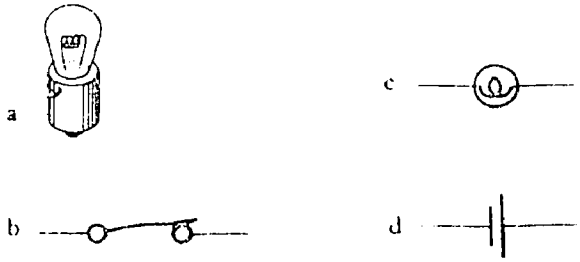
14. Which of the symbols in this schematic indicates a conductor wire?

(A) _____
(B) _____
(C) _____
(D) _____



15. Any device that uses electrical energy is called a load. Mark the schematic symbol that represents the load in the circuit we have considered.

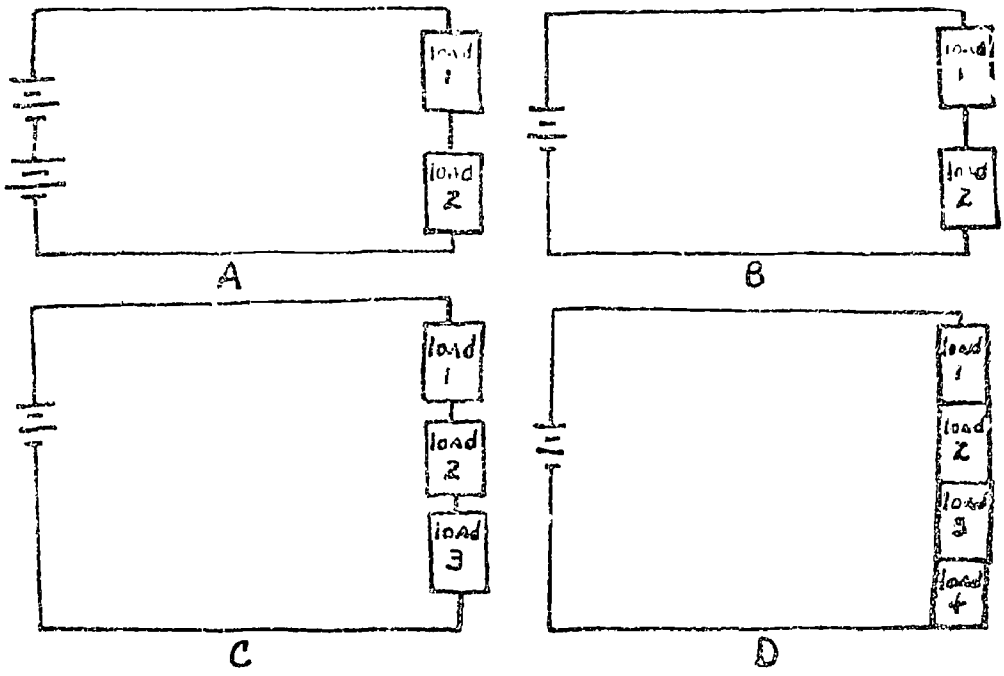
(A) _____
(B) _____
(C) _____
(D) _____



77.01.01.04

16. Which of the following circuits will have the greater current flow?

(A) _____
(B) _____
(C) _____
(D) _____



17. When converted to scientific notation, the number 1560 becomes:

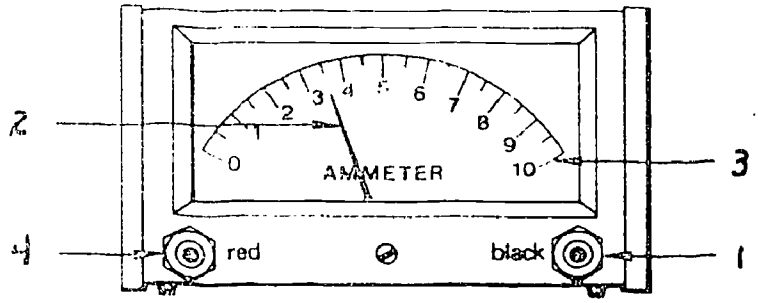
(A) 1.56×10^{2}
(B) 15.6×10^{1}
(C) 0.156×10^{-1}
(D) 1.56×10^{3}

77.01.01.05

18. Which of the following statements is correct?
(a) the ammeter is used to measure coulombs per second and is represented schematically by - —(A)—
(B) the basic unit of electron current is the volt
(C) when measuring current, the ammeter must be connected in parallel
(D) polarity may not be observed when connecting ammeter into the circuit

19. Which part of the ammeter is the negative terminal?

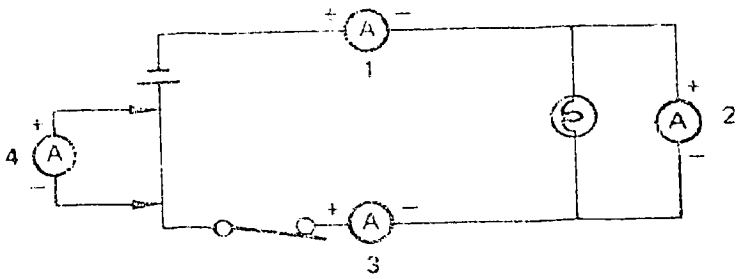
(A) 4
(B) 2
(C) 3
(D) 1



20. Current through an ammeter flows:
(A) in at the positive terminal and out at the negative terminal
(B) in at the negative terminal and out at the negative terminal
(C) in at the negative terminal and out at the positive terminal
(D) in at the positive terminal and out at the positive terminal

77.01.01.05 (continued)

21. Which meter is properly connected for taking current measurements?
    (A) meter 3
    (B) meter 1
    (C) meter 2
    (D) meter 4



22. With respect to the voltage source, an ammeter should always be placed in a curcuit:
    (A) in series
    (B) in parallel
    (C) as close as possible to the voltage source
    (D) at any location in the circuit

77.01.02.01

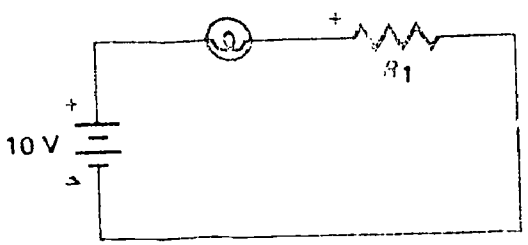
23. When we say that a battery is a source of power, we mean that the battery's voltage is:
    (A) likely to be unreliable
    (B) dangerous to measure
    (C) an electromotive force, or emf
    (D) always 110 volts

24. Check the phrase that correctly defines current flow:
    (A) free electrons moving in one direction
    (B) free electrons moving in one direction capable of doing work
    (C) random drift of electrons causing heat
    (D) free electrons moving in all directions creating energy

25. In a series circuit, the potential difference between two points is expressed in terms of:
    (A) joules/coulomb
    (B) watts
    (C) volts
    (D) ohms

26. Electrical energy is expressed in:
    (A) watts
    (B) coulombs per second
    (C) watt-seconds
    (D) current

27. In this circuit V_{R1} is a voltage:
    (A) resistance
    (B) rise
    (C) zero
    (D) drop



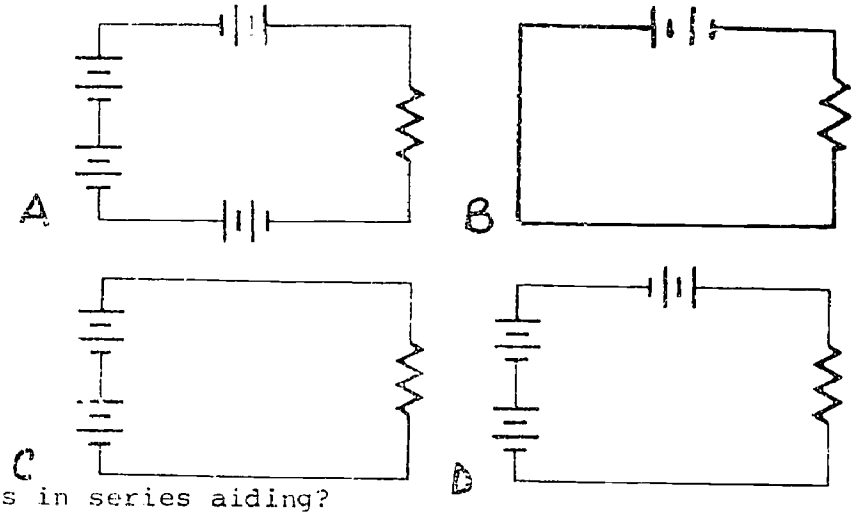
77.01.02.02

28. A battery consists of:
    (A) cells
    (B) resistance elements
    (C) lamps
    (D) switches

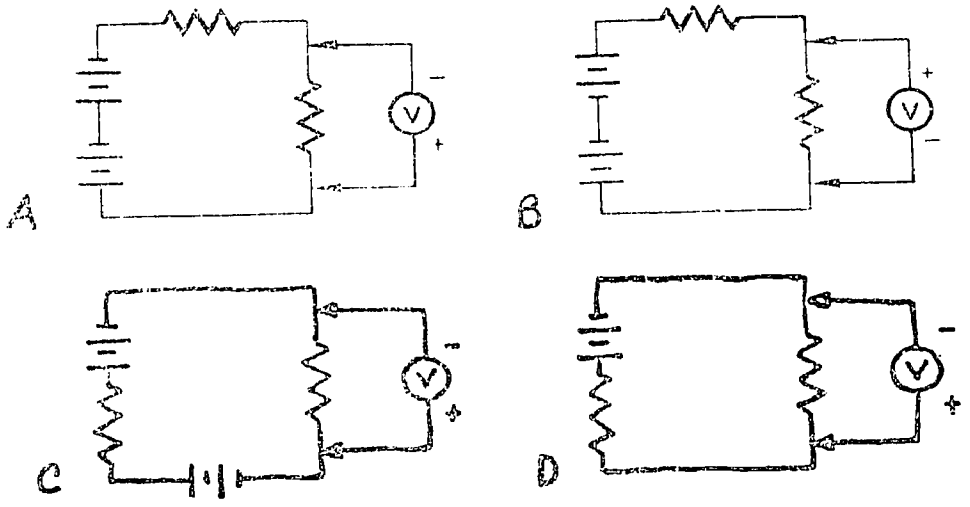
29. The dry cell provides the electromotive force to a circuit by converting chemical energy to:
    (A) chemical energy
    (B) light
    (C) heat
    (D) electrical energy

30. Current flow inside a dry cell is from:
    (A) negative to negative
    (B) negative to positive
    (C) positive to negative
    (D) positive to positive

31. Which of the following schematics would result in the greatest current?
    (A) _____
    (B) _____
    (C) _____
    (D) _____

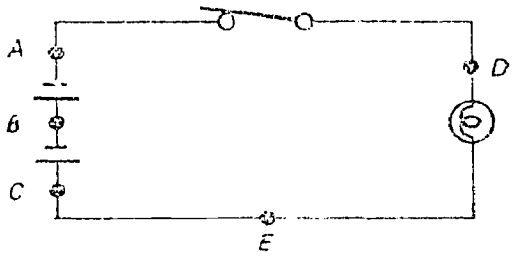


32. Which circuits show batteries in series aiding?
    (A) _____
    (B) _____
    (C) _____
    (D) _____



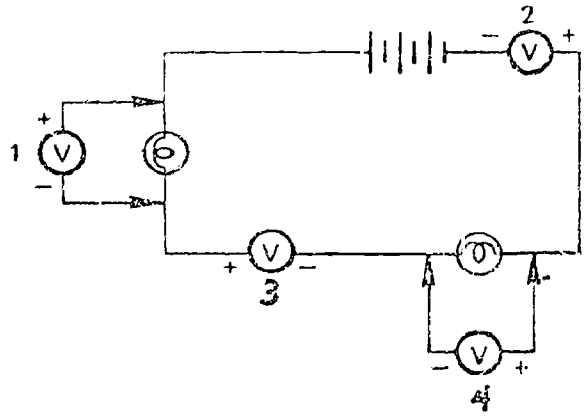
77.01.02.03

33. Between what points can voltage be measured?
    (A) A and B
    (B) A and D
    (C) C and E
    (D) D and E



34. In a series circuit, the potential difference between two points is expressed in terms of:
    (A) ohms
    (B) watts
    (C) joules/sec
    (D) volts

35. Which meter is correctly connected for measuring DC voltage?
    (A) meter 3
    (B) meter 2
    (C) meter 1
    (D) meter 4



36. Current inside a dry cell flows from:
    (A) negative to positive
    (B) positive to positive
    (C) negative to negative
    (D) positive to negative

37. Electrical energy is expressed in:
    (A) coulombs per second
    (B) watt-seconds
    (C) watts
    (D) current

77.01.03.03

38. Check the correct statement. Electrical resistance:
    (A) has little or no effect on current
    (B) is the same in all materials that are the same size
    (C) limits the amount of current flow
    (D) assists voltage

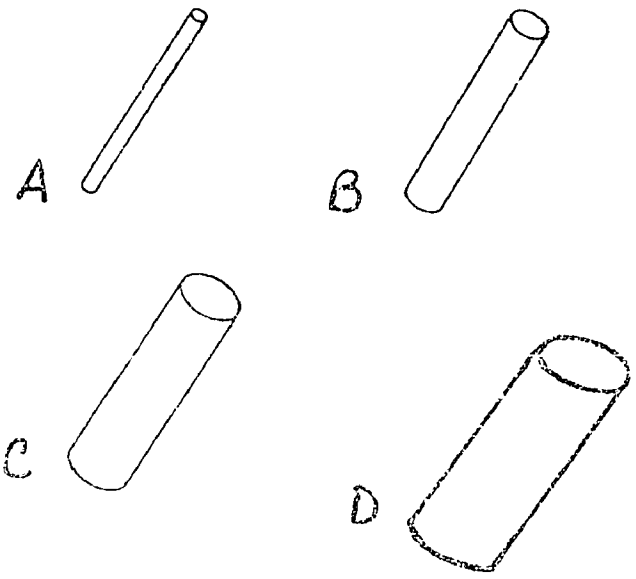
77.01.03.01 (continued)

39. Resistance is the property of a material that:
    (A) assists current flow
    (B) limits voltage
    (C) assists voltage
    (D) opposes current flow

40. If the length of a conductor is halved, its resistance will:
    (A) halve
    (B) triple
    (C) remain the same
    (D) double

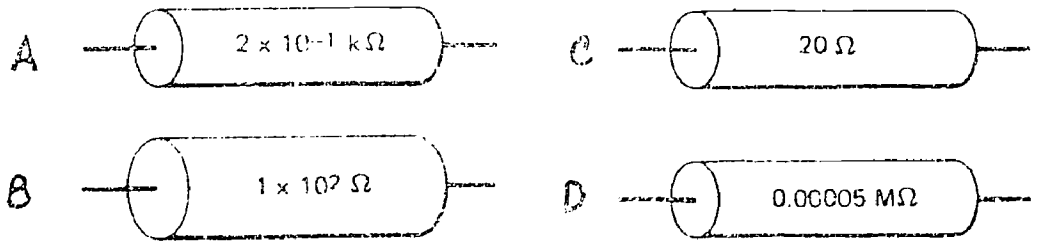
41. Which of the following accurately describes the conversion from electrical energy to heat energy within a resistance?
    (A) voltage drop
    (B) power loss
    (C) current loss
    (D) rise in potential

42. Which section of copper wire has the most resistance?
    (A) _____
    (B) _____
    (C) _____
    (D) _____



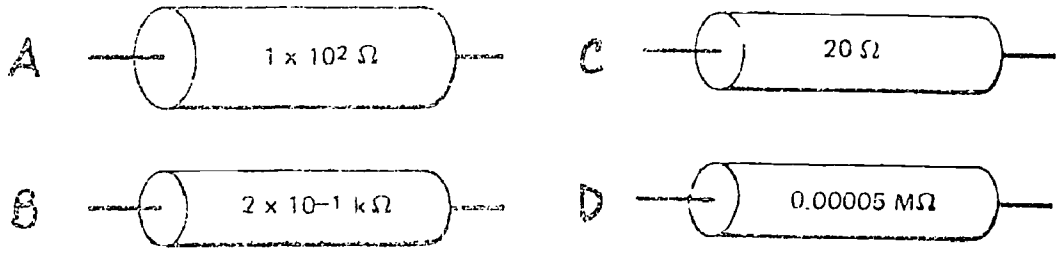
77.01.03.02

43. Which of the following resistors has the highest ohmic value?
    (A) _____
    (B) _____
    (C) _____
    (D) _____



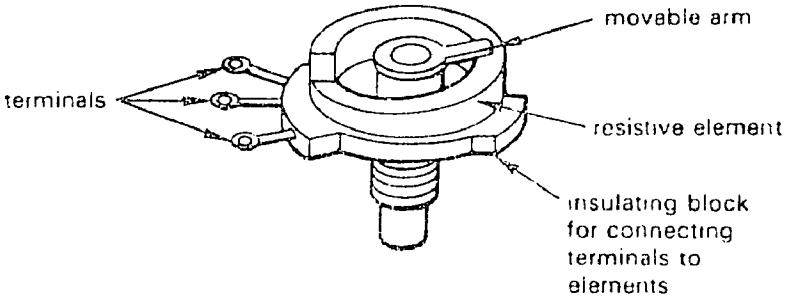
77.01.03.02

44. Which of the following resistors has the highest wattage rating?
(A) _____
(B) _____
(C) _____
(D) _____

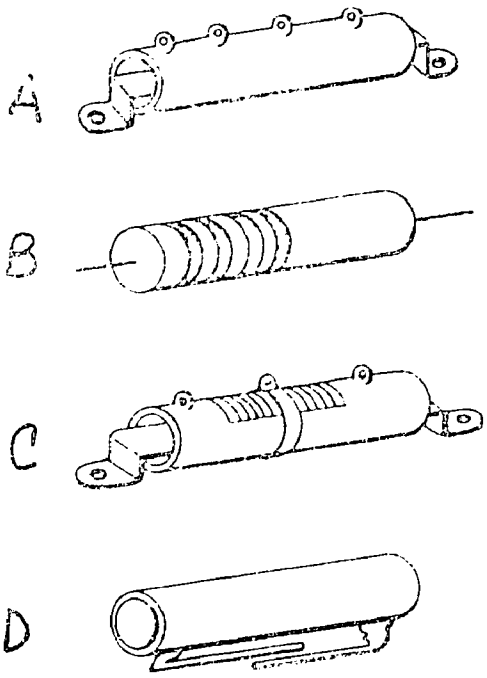


45. The wattage rating of a resistor:
(A) determines a resistor's ohmic value
(B) is determined by the resistor's physical size
(C) determines the maximum current a resistor can safely carry
(D) refers to the amount of resistance possessed by a resistor

46. This diagram shows a:
(A) potentiometer
(B) rheostal
(C) sliding contact resistor
(D) tapped resistor



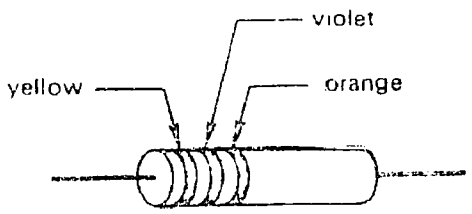
47. Select the resistor for the schematic symbol 
(A) _____
(B) _____
(C) _____
(D) _____



77.01.03.03

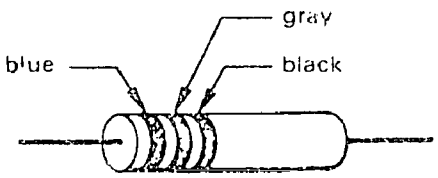
48. The color which indicates a tolerance value of 10% is:
(A) violet
(B) silver
(C) gold
(D) black

49. The ohmic value of the resistor shown is:
(A) 470 k ohms
(B) 36 k ohms
(C) 360 k ohms
(D) 47 k ohms

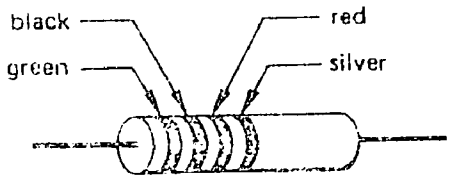


50. A resistor is coded with four color bands. The first band is green, the second is blue, the third is orange, and the fourth is gold. What is the value of this resistor?
(A) 67 k ohms
(B) 45 k ohms
(C) 56 k ohms
(D) 560 k ohms

51. What is the ohmic value of the resistor shown?
(A) 570 ohms
(B) 57 ohms
(C) 68 ohms
(D) 680 ohms

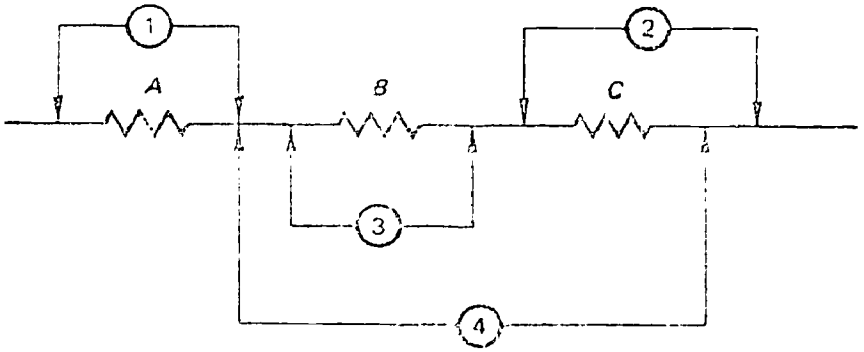


52. The minimum and maximum values for this resistor are:
(A) 9300 ohms and 9700 ohms
(B) 820 ohms and 860 ohms
(C) 6200 ohms and 6600 ohms
(D) 4500 ohms and 5500 ohms



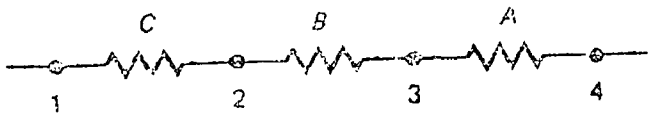
77.01.03.04

53. In the schematic shown, which ohmmeter will indicate the value of resistor B?
(A) 4
(B) 1
(C) 2
(D) 3



77.01.03.04 (continued)

54. On the diagram shown, to measure the combined resistance of resistors A and B, an ohmmeter must be connected between points:
(A) 1 and 3
(B) 1 and 4
(C) 2 and 3
(D) 2 and 4



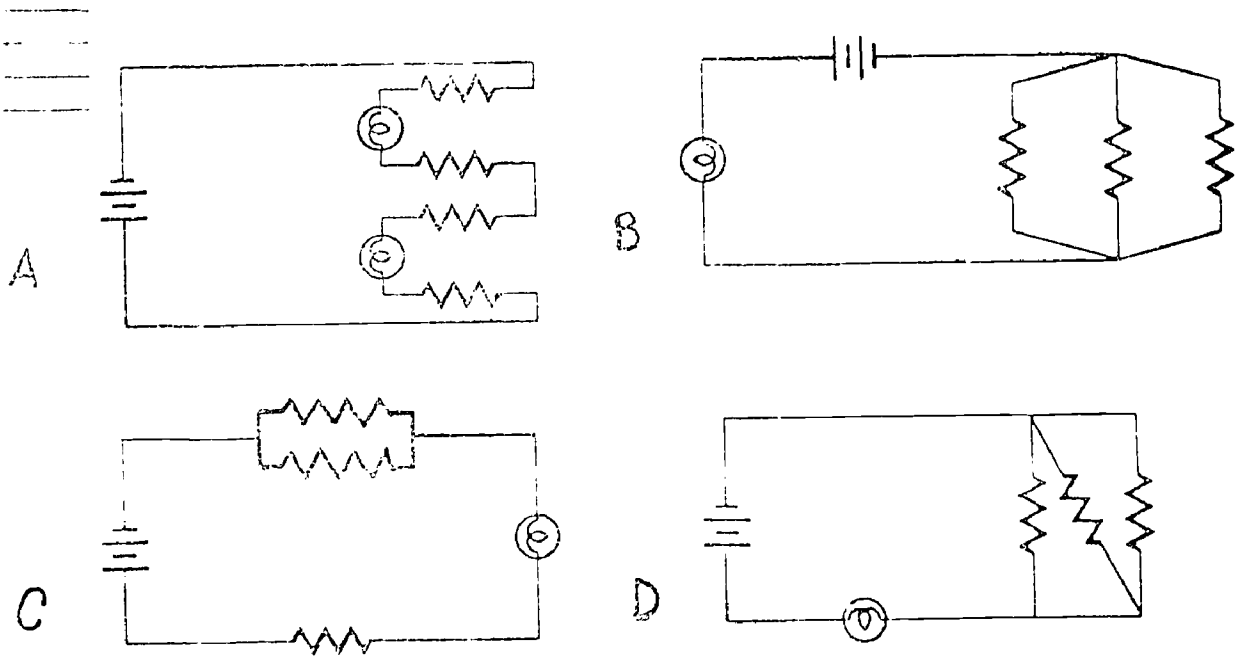
55. When resistance is measured using the ohms function of a multimeter, minimum resistance values will be indicated on the ohms scale when the meter pointer is at the:
(A) linear portion
(B) extreme right
(C) extreme left
(D) center

56. Which of the following correctly expresses the relationship of current, charge, and time?
(A) coulombs = seconds/ampere
(B) amperes = seconds/coulomb
(C) amperes = coulombs/second
(D) coulombs = amperes/second

57. If 2 coulombs pass a given point in 4 seconds, how much is the current?
(A) 8 amperes
(B) 0.5 amperes
(C) 2 amperes
(D) 4 amperes

77.01.04.01

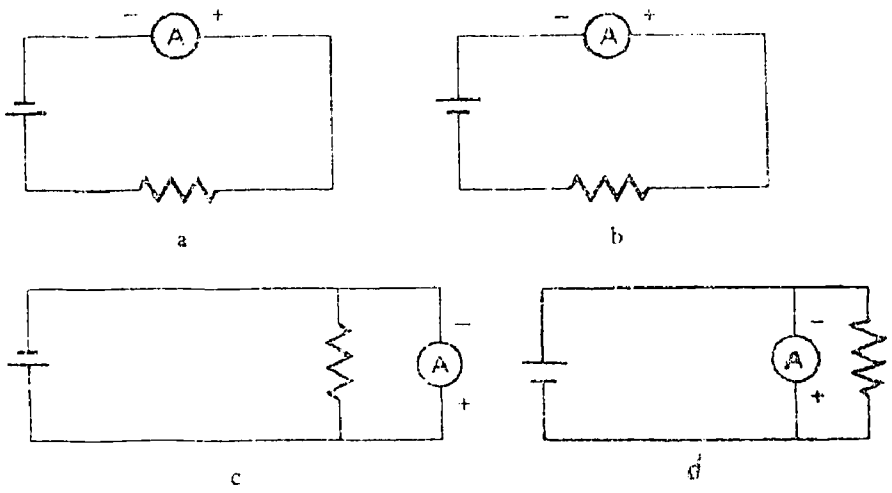
58. Which of the following schematics is a series circuit?
(A)
(B)
(C)
(D)



77.01.04.01 (continued)

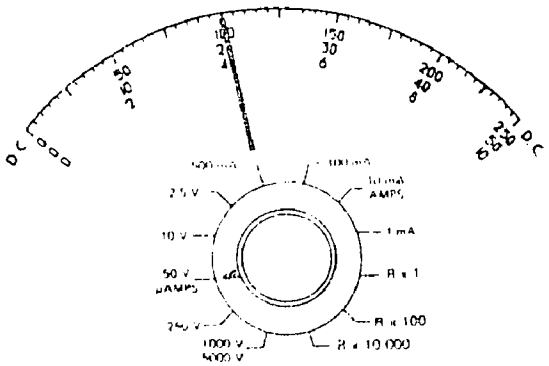
59. Which schematic shows the meter correctly installed for measuring current?

(A) _____
(B) _____
(C) _____
(D) _____



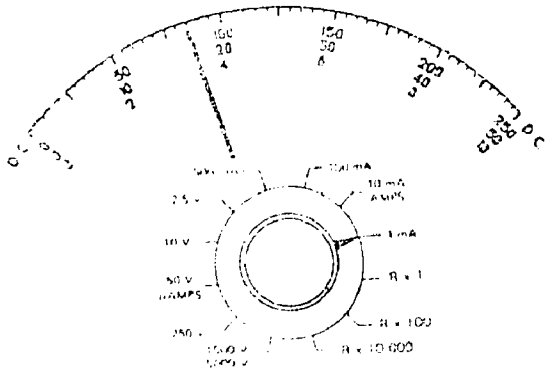
60. What is the current reading on the meter shown below?

(A) 20 uA
(B) 100 uA
(C) 4 uA
(D) 20 A



61. What is the current reading indicated below?

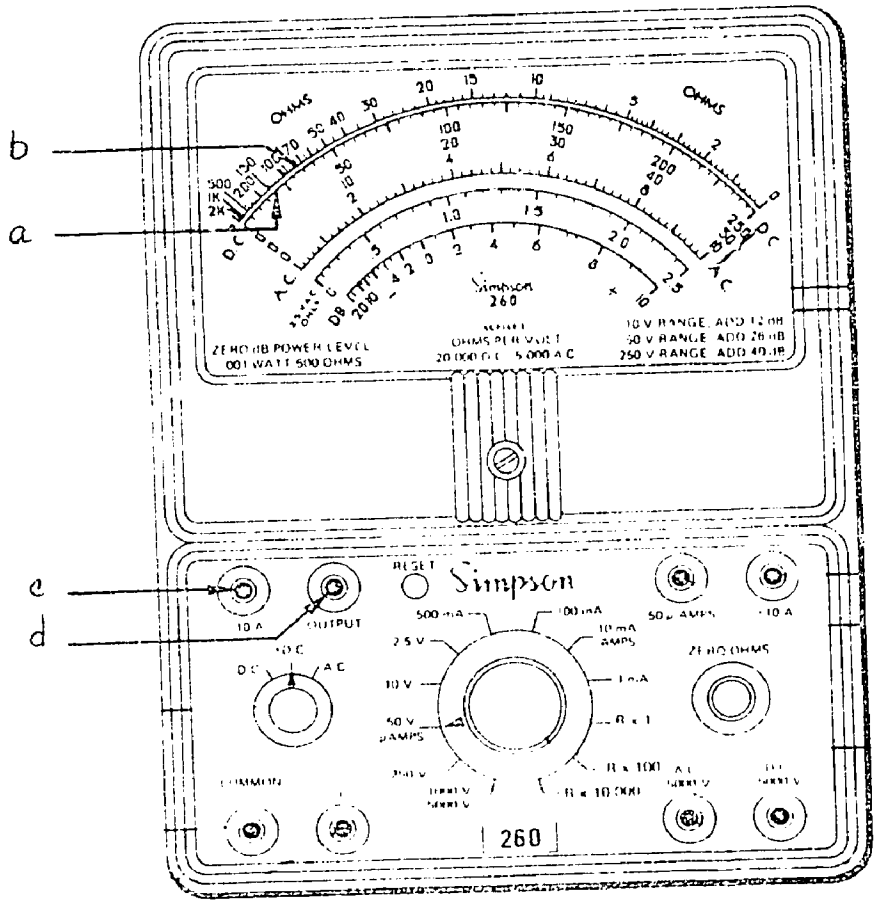
(A) 64 uA
(B) 0.64 mA
(C) 0.17 mA
(D) 0.34 mA



77.01.04.01 (continued)

62. Assuming the maximum current to be measurred would be 50 uA, check the lettered part of the multimeter that is used for measuring DC current:

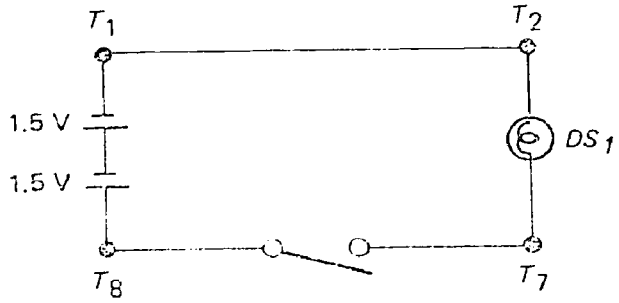
(A) _____
(B) _____
(C) _____
(D) _____



77.01.04.02

63. If the switch is closed to energize the circuit shown, what voltage would be measured at the source (between T_1 and T_8)?

(A) 4.5 V
(B) 3 V
(C) 1.5 V
(D) 0 V

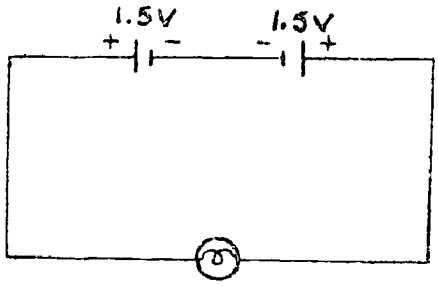


64. Check the statement that is correct:

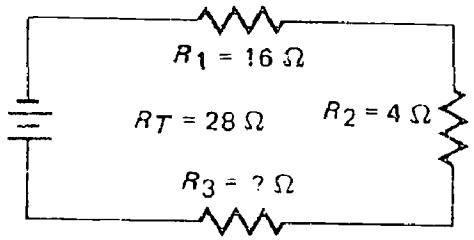
(A) voltage registers across a load because of a voltage drop
(B) voltage registers across a closed switch because of a voltage drop
(C) there is no voltage drop across any component
(D) voltage registers across a closed switch because of a rise in potential

77.01.04.02 (continued)

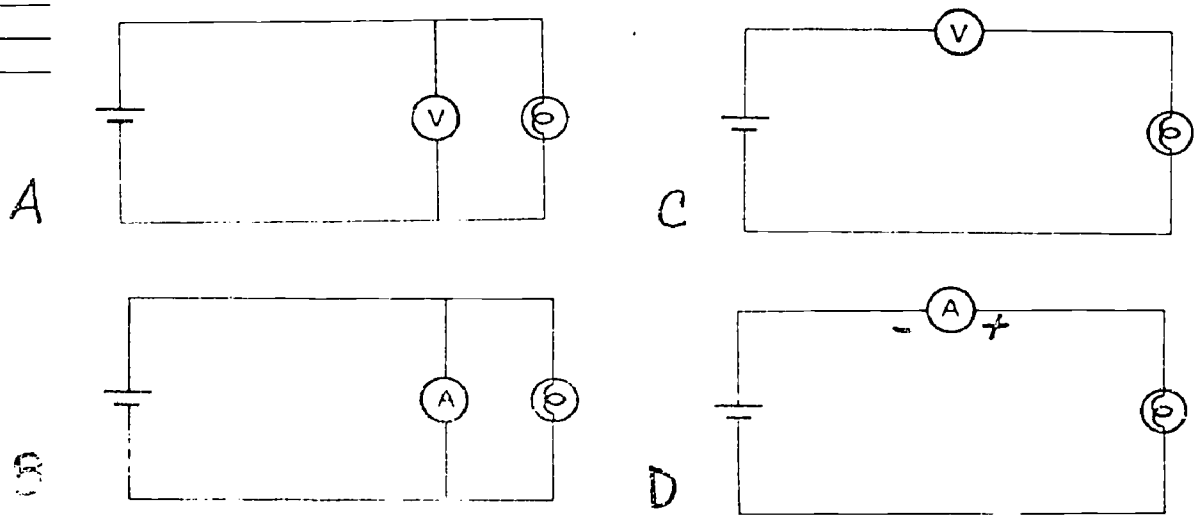
65. What is the potential difference across the lamp in the circuit shown?
(A) 2 v
(B) 1.5 V
(C) 3 V
(D) 0 V



66. What is the resistance of R_3?
(A) 8 ohms
(B) 12 ohms
(C) 18 ohms
(D) 20 ohms



67. Check the schematic that is correct:
(A) _____
(B) _____
(C) _____
(D) _____



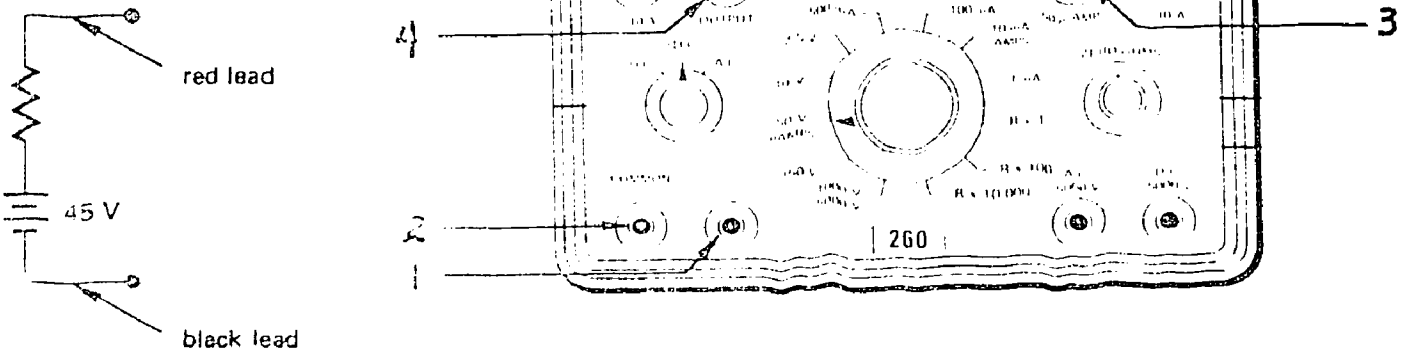
77.01.04.03

68. Check the statement that is true:
(A) when measuring AC voltage with a multimeter, the function switch is not used
(B) polarity does not have to be observed when measuring AC voltages
(C) the black DC arc on the Simpson 260-5P is used for measuring AC voltages
(D) the figures below the red arc on the Simpson 260-5P are used for measuring AC voltages

77.01.04.03 (continued)

59. To measure DC voltages, a voltmeter must be connected:
    (A) with its red lead to the negative side of the component being measured and black lead to the positive side
    (B) in series with the load being measured
    (C) in series with the component or source to be measured
    (D) across a potential difference

70. The multimeter shown is to be used to measure DC voltage. To what terminal should the positive lead be connected?
    (A) 3
    (B) 2
    (C) 1
    (D) 4



77.01.04.03 (continued)

71. Check the statement that is true:
(A) when measuring voltage with a multimeter, the function switch must always be in the +DC position
(B) when reading DC voltage, polarity must be observed
(C) when measuring DC voltage with a multimeter, correct meter connection will cause pointer deflection to the left of zero
(D) meter polarity of the Simpson 260-5P can only be changed by removing the test leads from the circuit and reversing them

72. Since DC voltmeters are polarity sensitive, the red lead should be connected to:
(A) both sides of the source
(B) the negative side of the source
(C) either side of the source
(D) the positive side of the source

77.01.05.01

73. The statement "circuit current is directly proportional to the applied voltage and inversely proportional to circuit resistance" is known as:
(A) Weber's theory
(B) Kirchoff's law
(C) Joule's law
(D) Ohm's law

74. Which of the following mathematically expresses Ohm's law?

(A) $P = \frac{W}{T}$ (C) $I = \frac{E}{R}$

(B) $P = IE$ (D) $W = FD$

75. The effect of resistance on current is expressed by:

(A) $P = \frac{W}{T}$ (C) $Q = IT$

(B) $E = IR$ (D) $F = \frac{W}{D}$

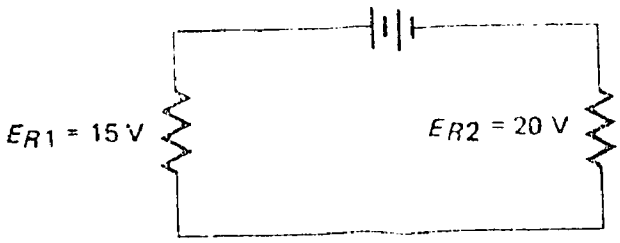
76. If the value of voltage applied to a circuit is physically doubled while circuit resistance is unchanged, circuit current will:
(A) increase by four times
(B) decrease by four times
(C) remain the same
(D) double

77. Which of the following correctly describes an inversely proportional relationship?
(A) resistance increases, current decreases
(B) resistance decreases, current decreases
(C) resistance increases, current increases
(D) R increases, I increases

77.01.05.02

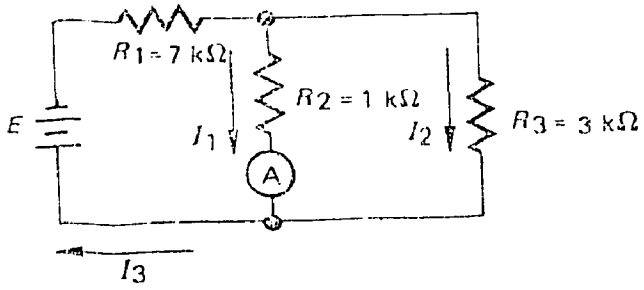
78. Compute the source voltage (E) for the following schematic:

(A) 20 V
(B) 45 V
(C) 35 V
(D) 15 V



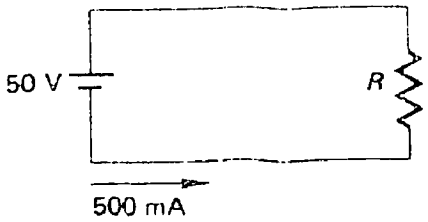
79. In the circuit shown, the ammeter shows a current of 100 mA. Using Ohm's law, find the value of I:

(A) 0.333 mA
(B) 133.3 mA
(C) 3.33 mA
(D) 33.3 mA



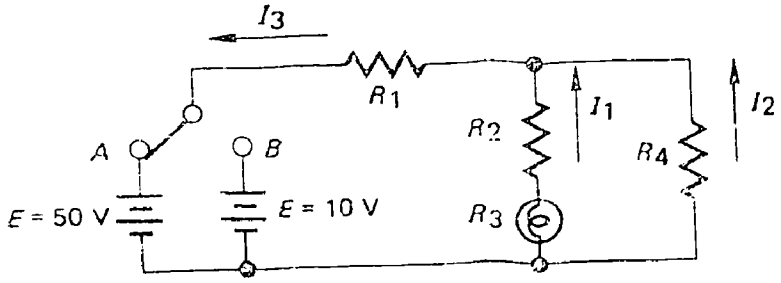
80. What is the value of R in the following circuit?

(A) 10 ohms
(B) 2500 ohms
(C) 100 ohms
(D) 50 ohms



81. In the circuit below, moving the switch from position A to position B will make I:

(A) remain the same
(B) decrease to one-fourth its original value
(C) decrease to one-fifth its original value
(D) decrease to one-sixth its original value

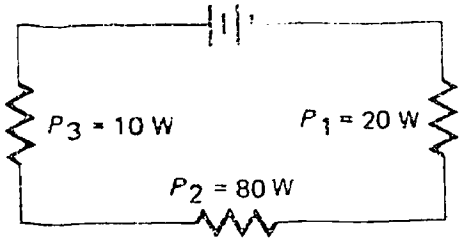


82. Refer to the circuit found in question 84. If the switch was kept in position B, but the value of R_1 was doubled, what would be the result?

(A) E would increase to 15 V
(B) the value of E would double
(C) no effect on E
(D) E will increase, although the new value of E cannot be computed unless the values of the circuit resistances are known

77.01.05.02

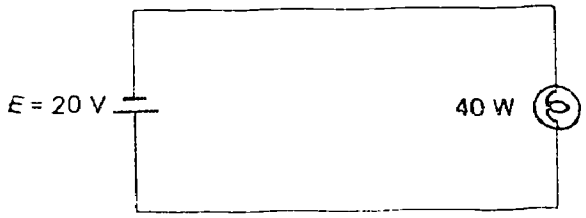
83. In the circuit represented by the diagram shown, how much power is supplied by the source?
(A) 0.15 W
(B) 110 W
(C) 10.0 W
(D) 100 W



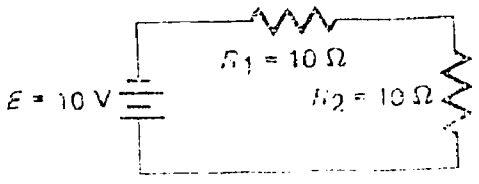
84. The amount of work done per unit time describes:
(A) voltage
(B) current
(C) power
(D) resistance

85. How much power is dissipated by a circuit containing 6 K of resistance when 2 mA of current is flowing?
(A) 1.2 W
(B) 2.4 mW
(C) 24 mW
(D) 12 W

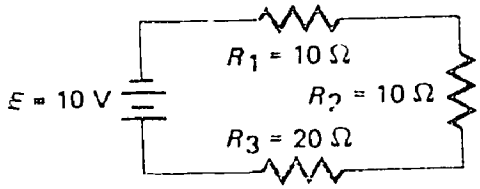
86. In this circuit, how much current will the light bulb draw?
(A) 3 A
(B) 4 A
(C) 2 A
(D) 1.5 A



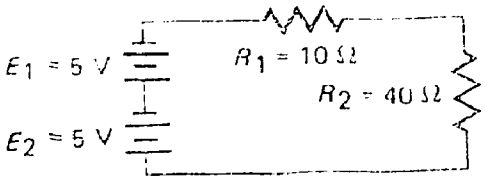
87. The circuit which consumes the most power is circuit:
(A) _____
(B) _____
(C) _____
(D) _____



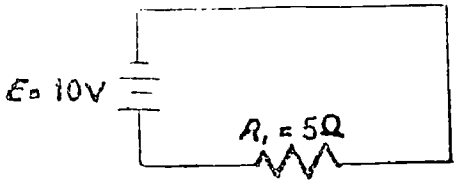
A



B



C



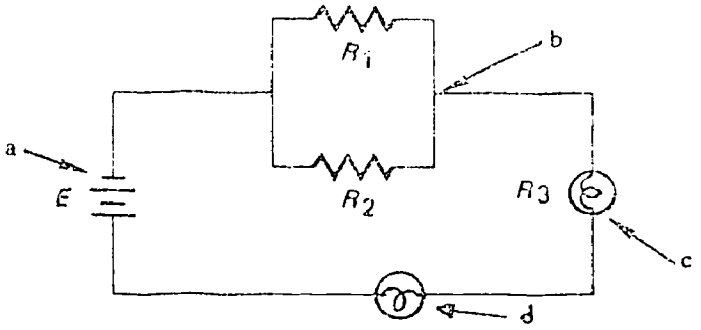
D

77.01.05,06

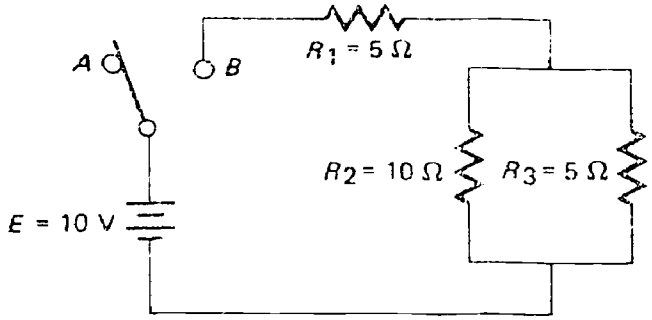
88. Increasing the load resistance will result in less circuit current and therefore the voltage dropped across the internal resistance will be:
(A) more
(B) less
(C) zero
(D) high

89. "Which phrase best defines internal resistance?"
(A) resistance across a load
(B) opposition that limits current flow and can be measured with an ohmmeter
(C) opposition that limits current flow and occurs within the wire
(D) opposition that limits current flow and occurs within the source

90. Where would the internal resistance be found in the circuit shown?
(A) _____
(B) _____
(C) _____
(D) _____



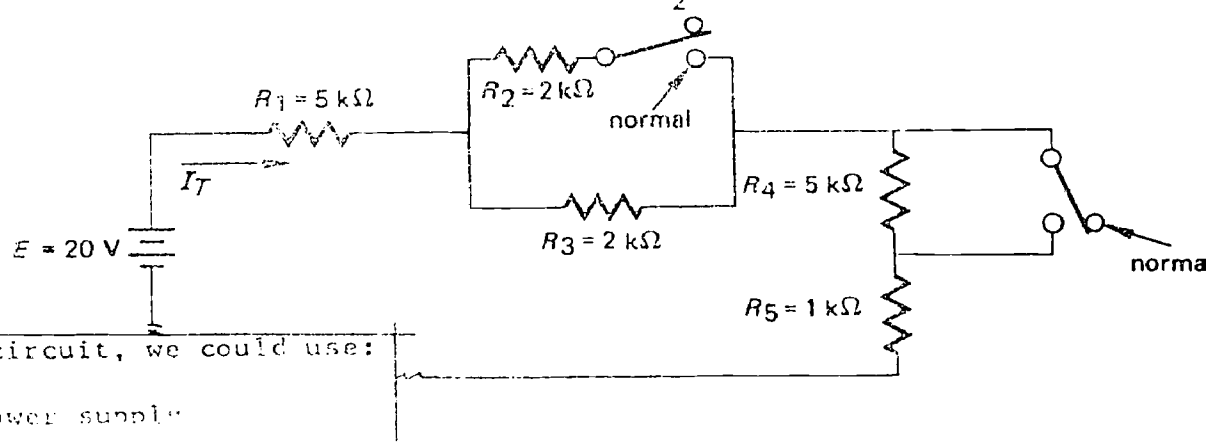
91. In the circuit shown below, E drops to 7.0 V when the switch is moved to position B. What is the value of internal resistance of the battery?
(A) 5.20 ohms
(B) 20.0 ohms
(C) 2.00 ohms
(D) 17.0 ohms



92. Identical values of circuit current and power can be obtained if the internal resistance of the voltage source is:
(A) known precisely
(B) ignored
(C) cancelled out when equal resistance is parallel with it
(D) raised

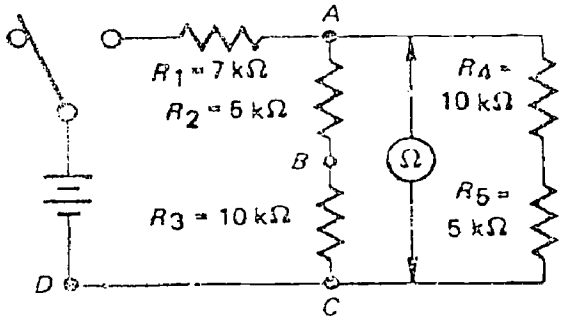
77.01.00.00

93. In the circuit shown, R_2 can be open, R_4 can be shorted, or all circuit elements can be normal. What is the total current with R_2 open?
(A) 2.9 mA
(B) 1.7 mA
(C) 1.5 mA
(D) 1.0 mA

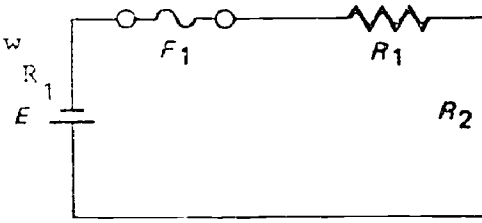


94. To locate a short circuit, we could use:
(A) an ammeter
(B) a regulated power supply
(C) a wattmeter
(D) an ohmmeter

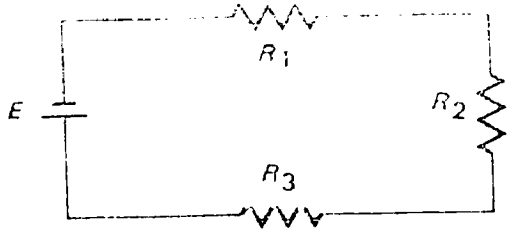
95. Give the ohmmeter reading between points A and C:
(A) 22 K ohms
(B) 4 ohms
(C) 15 K ohms
(D) 7.5 K ohms



96. In the circuit illustrated, the purpose of the component located between the negative terminal of the source and R_1 is to:
(A) increase the total resistance of the circuit
(B) allow greater current flow through R_1
(C) open the circuit in the event of excessive current flow
(D) drop some of the applied voltage and prevent damage to R_1



97. Compare the table of ohmmeter and voltmeter readings taken from this circuit under normal and abnormal conditions. (Voltage readings are taken with the switch closed, resistance readings with the switch open). State the trouble that exists in the circuit to cause the abnormal readings.
(A) R_1 is open
(B) R_2 is open
(C) R_2 is shorted
(D) R_1 is open

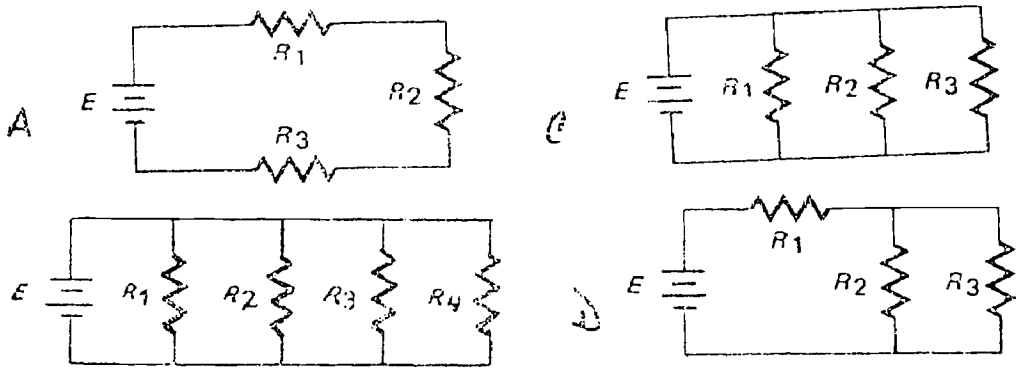


	normal	abnormal
E	75 V	75 V
R_T	75 Ω	50 Ω
R_1	25 Ω	25 Ω
R_2	25 Ω	25 Ω
R_3	25 Ω	0 Ω
E_{R1}	25 V	37.5 V
E_{R2}	25 V	37.5 V
E_{R3}	25 V	0 V

77.01.06.01

98. In the following diagrams, current is the common value of circuit:

(A) _____
(B) _____
(C) _____
(D) _____



99. Which of the following equations is the mathematical expression for total voltage in a parallel circuit?

(A) $E_T = E_1 = E_2 = E_3 = \ldots = E_n$

(B) $E_T = E_1 \times E_2 \times E_3 \times \ldots \times E_n$

(C) $E_T = E_1 + E_2 + E_3 + \ldots + E_n$

(D) $E_T = E_1 - E_2 - E_3 - \ldots - E_n$

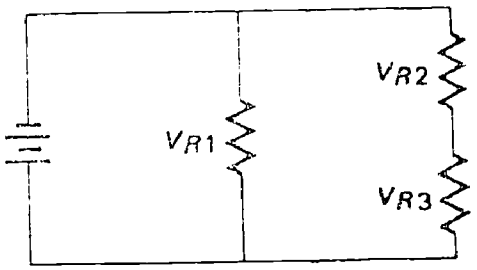
100. Which of the following expressions is a correct statement of Kirchhoff's voltage law for the circuit represented by the diagram shown?

(A) $E_T = V_{R1} = (V_{R2} \times V_{R3})$

(B) $E_T = V_{R1} = (V_{R2} + V_{R3})$

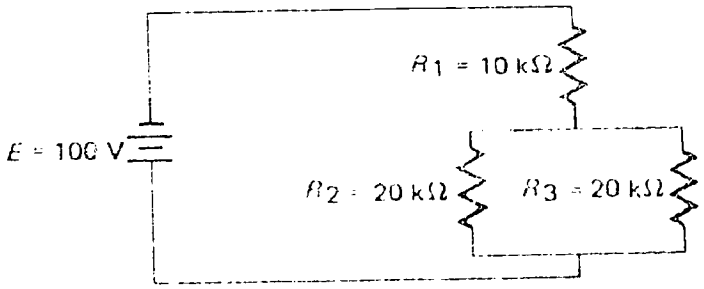
(C) $E_T = V_{R1} + V_{R2} = V_{R3}$

(D) $E_T = V_{R1} + (V_{R2} = V_{R3})$



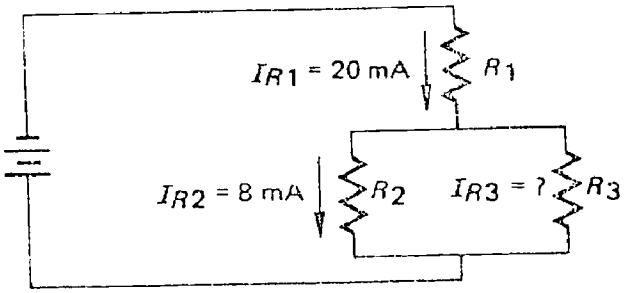
101. What is the value of total circuit current?

(A) 5 mA
(B) 2.5 mA
(C) 10 mA
(D) 15 mA



77.01.06.01 (continued)

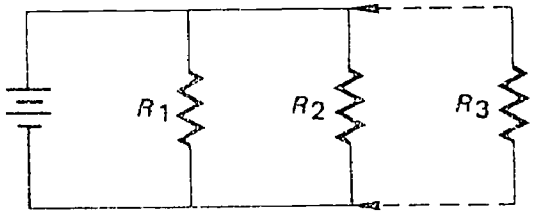
102. What is the value of the current flowing through R_3?
(A) 28 mA
(B) 8 mA
(C) 10 mA
(D) 12 mA



77.01.06.02

103. Which of the following describes the relationship between the equivalent resistance and the individual branch resistance of a parallel circuit?
(A) smaller than the smallest branch resistance
(B) greater than the largest branch resistance
(C) equal to the sum of the branch resistance
(D) equal to the smallest branch resistance

104. In the circuit represented by the diagram shown, when R_3 is connected the equivalent resistance will:
(A) decrease
(B) double
(C) increase
(D) not change



105. What is the value of the equivalent resistance of a three-branch parallel circuit that contains resistors of 20 ohms, 30 ohms, and 60 ohms?
(A) 0.6 ohms
(B) 0.1 ohms
(C) 10 ohms
(D) 110 ohms

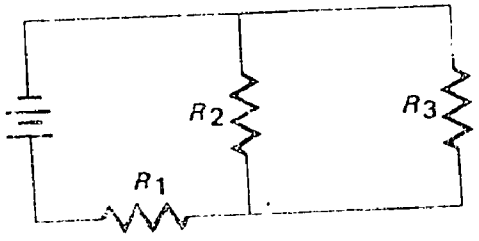
106. Which of the following expression shows the correct relationship between total and individual resistance for the circuit represented by the diagram?

(A) $R_t = R_1 + \frac{(R_2 \times R_3)}{R_1 \times (R_2 + R_3)}$

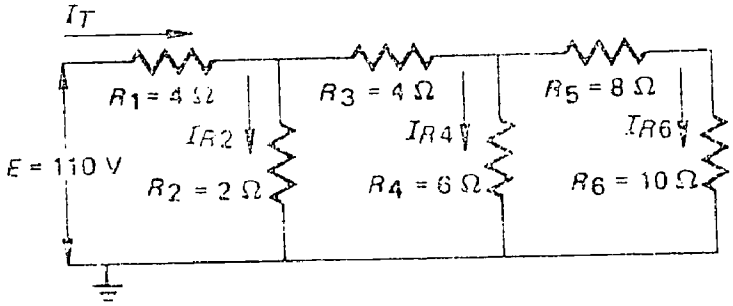
(B) $R_t = R_1 - \frac{R_2 \times R_3}{R_2 + R_3}$

(C) $R_t = \frac{R_1 \times (R_2 + R_3)}{R_1 + (R_2 + R_3)}$

(D) $R_t = R_1 + \frac{R_2 \times R_3}{R_2 + R_3}$

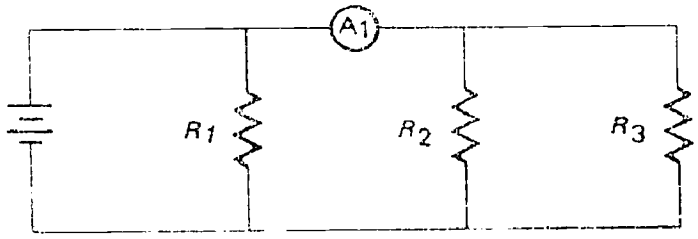


107. What is the total resistance of this network?
(A) 3.62 ohms
(B) 5.62 ohms
(C) 7.62 ohms
(D) 6.62 ohms

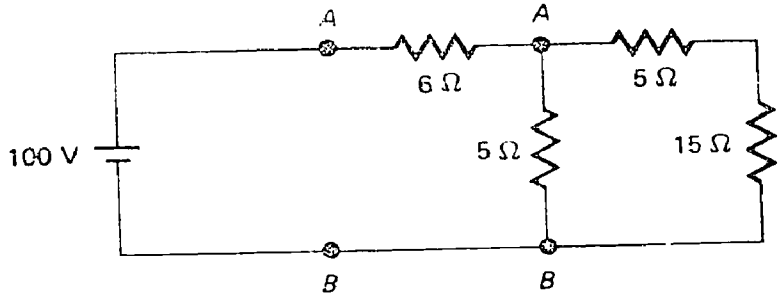


77.01.06.03

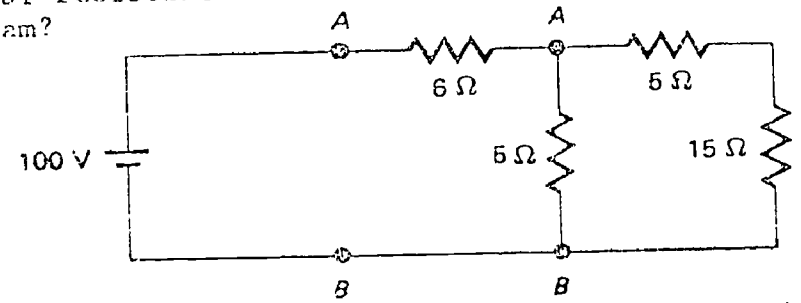
108. In the circuit represented by the diagram shown, if R_1 shorts, the indication on ammeter A_1 will:
(A) remain steady
(B) decrease
(C) increase
(D) drop to zero



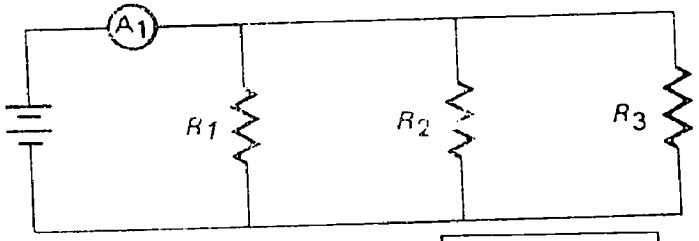
109. What is the total current flowing?
(A) 10 A
(B) 5 A
(C) 15 A
(D) 20 A



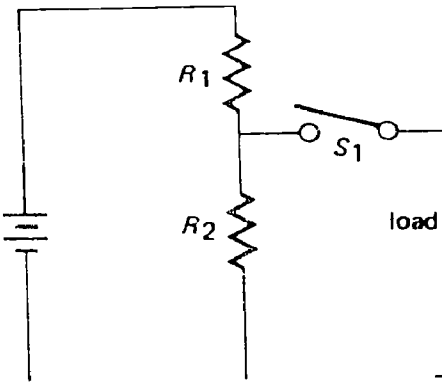
110. What is the total resistance measured between points A and B in the following diagram?
(A) 11 ohms
(B) 10 ohms
(C) 20 ohms
(D) 26 ohms



111. In the circuit diagram shown, if R_1 opens, the reading on A_1 will:
(A) increase by the value of I_1
(B) decrease to zero
(C) not change
(D) decrease by the value of I_1



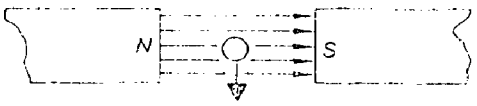
112. What effect will closing S1 have on total circuit current?
(A) total circuit current will decrease
(B) total circuit current will increase
(C) total circuit current will double
(D) total circuit current will not change



77.01.06.04

113. If a conductor is moved down through the magnetic field as shown, a voltage is induced in the moving conductor. If the magnet is moved up as the conductor is moved down the induced voltage will be:

(A) zero.
(B) the same.
(C) greater.
(D) smaller

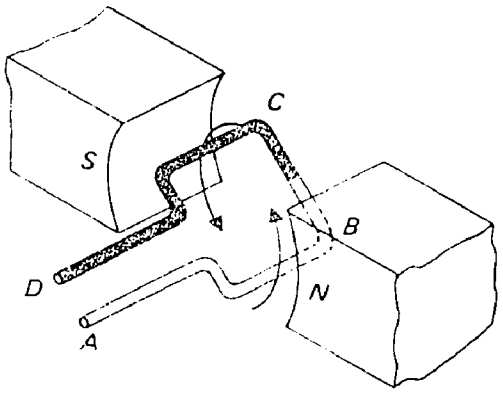


114. When a conductor is moved across the lines of force of a magnetic field,

(A) the motion of the lines of force past the electrons in the conductor causes electrons to move toward one end of the conductor.
(B) a current is induced in the conductor.
(C) the resulting current induces a potential difference between the two ends of the conductor.
(D) all of the above.

115. If the loop continues to turn, the same points on the conductor will be in this position. Now:

(A) point D is positive with respect to point C.
(B) point A is negative with respect to point B.
(C) point A is positive with respect to point B.
(D) point A is negative with respect to point C.



116. The electron movement induced in a circuit the instant after the switch is closed is:

(A) in the same direction as the circuit current.
(B) toward the negative terminal of the source.
(C) in the opposite direction from the source current.
(D) from negative to positive.

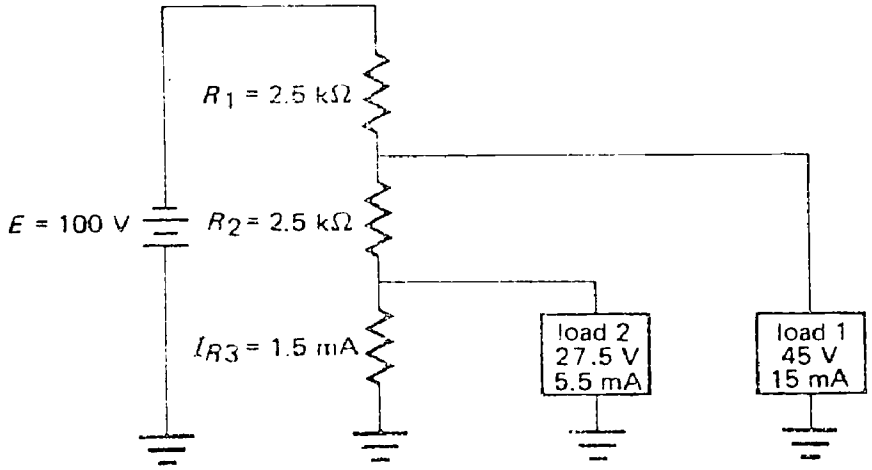
117. When a circuit in which current has been flowing reaches a steady state and the switch is then opened, the magnetic field around the conductor starts to collapse and:

(A) all current flow immediately ceases.
(B) a counter-emf is set up by the induced voltage.
(C) the voltage induced by the collapsing field tends to keep the circuit current flowing.
(D) all voltage ceases.

77.01.07.01

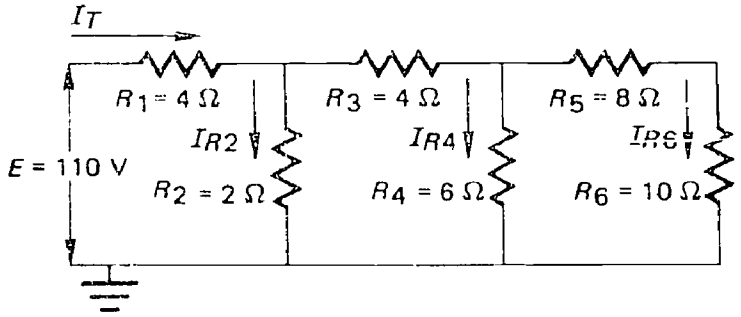
118. Using the circuit provided, solve for I_{R2}.

(A) 2.2 mA
(B) 7 mA
(C) 22 mA
(D) .7 mA



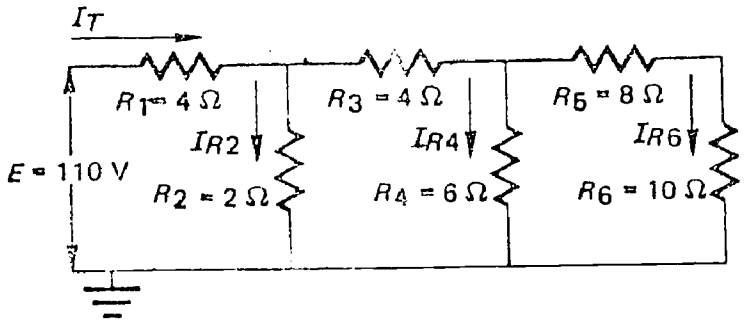
119. What is the value of current I_{R2} in amperes?

(A) 2.8 A
(B) 15.8 A
(C) 10.8 A
(D) 12.8 A



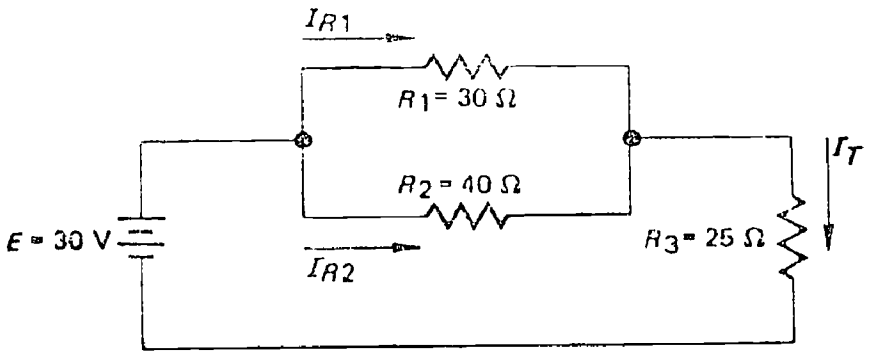
120. What is the total current in amperes furnished by the 110-V source to this network?

(A) 0.196 A
(B) 196 A
(C) 1.96 A
(D) 19.6 A



121. Use the circuit below to find the value of P_{R3}.

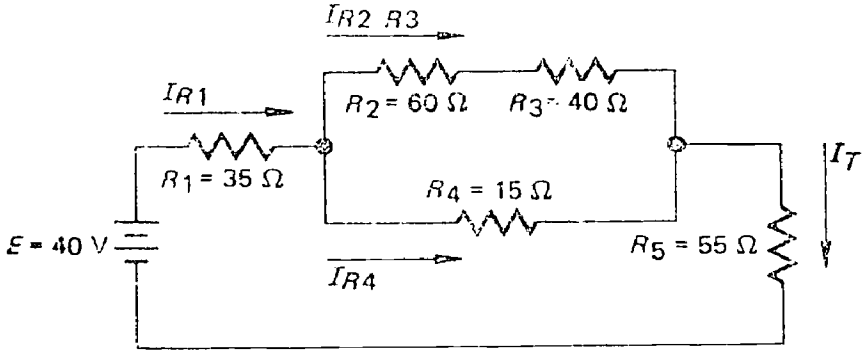
(A) 214 W
(B) 2.14 W
(C) 12.6 W
(D) 105 W



77.01.07.01 (continued)

122. Convert the circuit below to a simple equivalent circuit, and compute for V_{R5}.

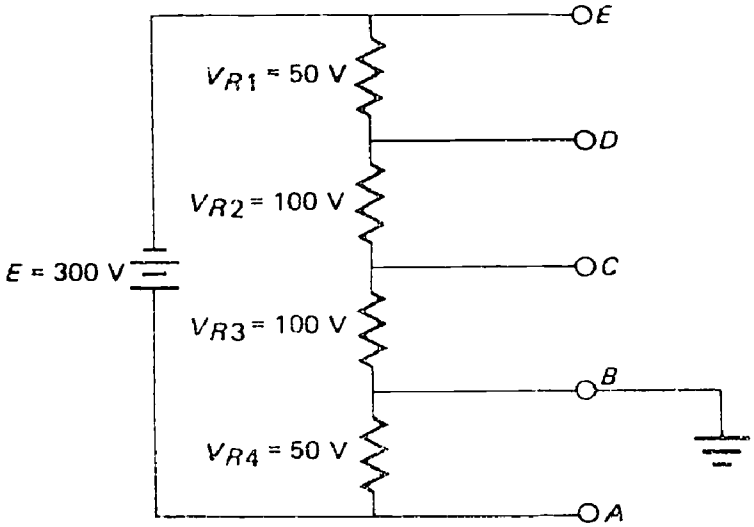
(A) 20 V
(B) 2.14 V
(C) 21.4 V
(D) 15 V



77.01.07.02

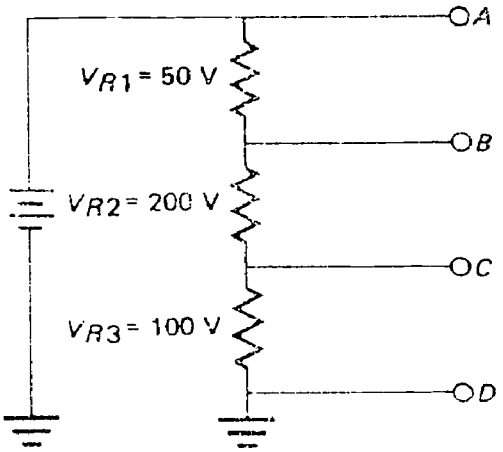
123. What are the magnitude and polarity of the voltage at point D with respect to ground?

(A) +100 V
(B) -100 V
(C) +200 V
(D) -200 V



124. What are the potential difference and polarity at point B with respect to A?

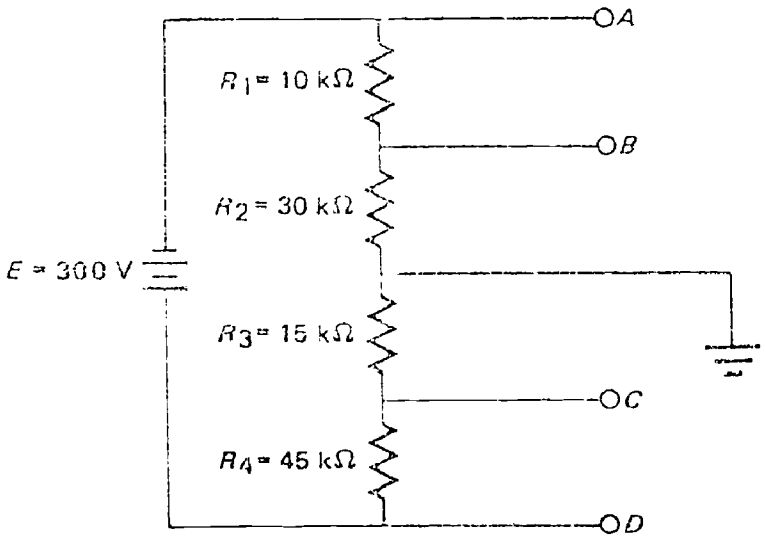
(A) +300 V
(B) +50 V
(C) +200 V
(D) -50 V



77.01.07.02 (continued)

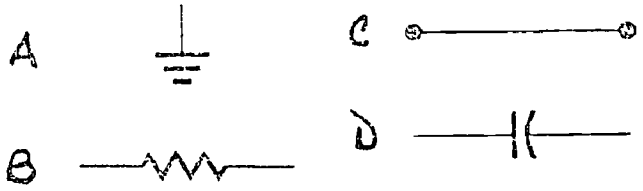
125. What are the polarity and the value of voltage at terminal B with respect to ground?

(A) +30 V
(B) -90 V
(C) -45 V
(D) -120 V



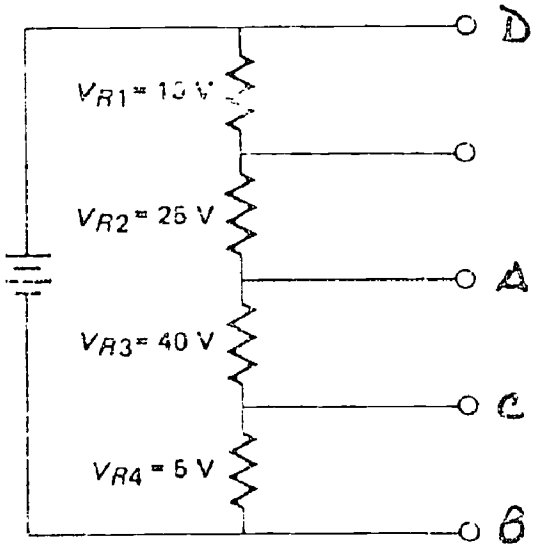
126. The symbol for the ground (reference) point is:

(A) ____
(B) ____
(C) ____
(D) ____



127. At which point in the diagram shown would we place ground, if we wanted point A 45V positive with respect to the chassis?

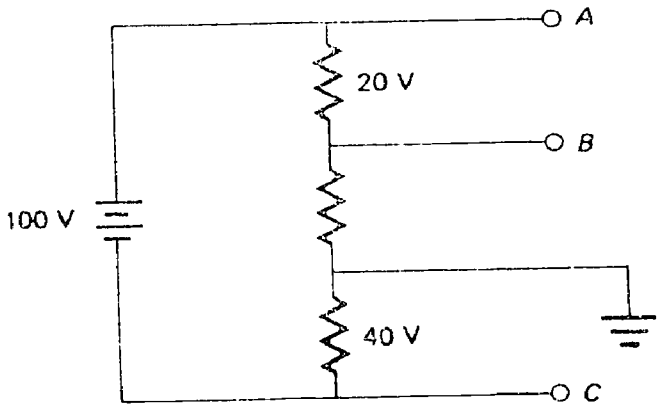
(A) ____
(B) ____
(C) ____
(D) ____



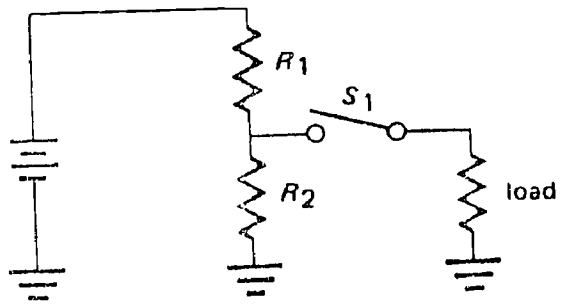
77.01.07.02

128 Which feature of a voltage divider enables it to supply voltages of positive and/or negative polarity?
(A) location of reference point
(B) number of series resistors
(C) size of resistors used
(D) number of loads attached

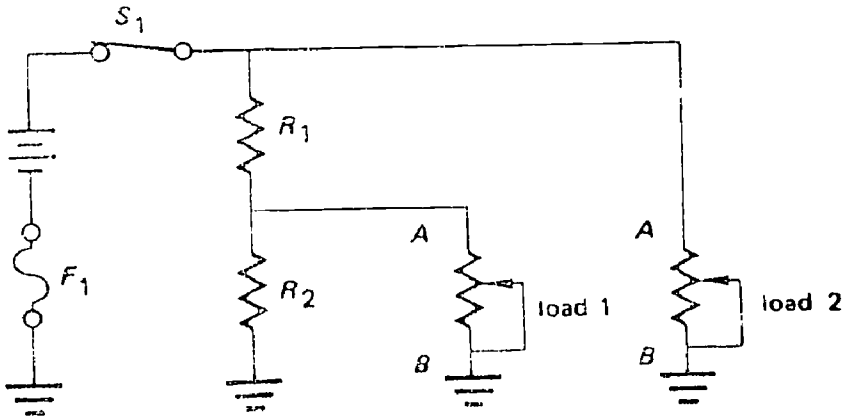
129. What is the magnitude and polarity of point A with respect to ground?
(A) negative 60 V
(B) negative 40 V
(C) positive 60 V
(D) positive 20 V



130. What effect will closing S1 have on total circuit current?
(A) total circuit current will double
(B) total circuit current will decrease
(C) total circuit current will increase
(D) total circuit current will not change

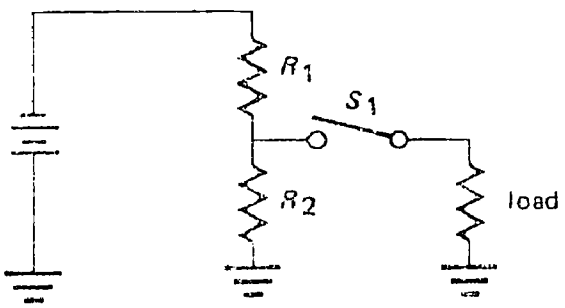


131. Moving the arm of load 1 to point A will cause V_{R1} to:
(A) decrease
(B) double
(C) increase
(D) stay the same



77.01.07.03 (continued)

132. What effect will closing S1 have on total resistance?
(A) not change
(B) increase
(C) decrease
(D) increase to infinity



77.01.08.01

133. Which correctly states the law of magnetic poles?
(A) lines of force repel each other
(B) like magnetic poles repel; unlike poles attract
(C) magnetic attraction will always be strongest at the poles
(D) lines of magnetic force are polarized

134. Around a magnet, the external lines of force:
(A) leave the magnet from the north pole and enter the south pole
(B) often cross each other
(C) leave the magnet from the south pole and enter the north pole
(D) may be broken by a piece of iron shielding

135. Magnetic lines of force:
(A) are "loops" like rubber bands
(B) attract each other
(C) exist parallel to a wire carrying DC
(D) repel each other

136. Which of the following magnetic materials is most "magnetic"?
(A) ferromagnetic
(B) diamagnetic
(C) paramagnetic
(D) iramagnetic

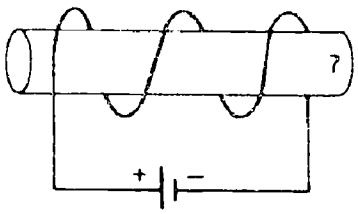
137. A piece of soft iron placed in the field of a strong magnet exhibits the properties of a magnet. The piece of soft iron has become a temporary magnet by:
(A) induction
(B) magnetic transfer
(C) osmosis
(D) fusion

77.01.03.02

138. Electromagnetism is the production of a magnetic field by:
(A) current flow through a conductor
(B) voltage across a divider
(C) induction through a resistor
(D) a generator

139. The direction of current flow is from:
(A) positive to positive
(B) positive to negative
(C) negative to positive
(D) negative to negative

140. The pole marked with a question mark:
(A) is a north pole
(B) is a south pole
(C) has no polarity
(D) is non-magnetic



141. A coil of 100 turns has 1 A flowing through it. To obtain an electromagnet of equal strength with only 20 turns, how many amperes would be required?
(A) 4 A
(B) 2 A
(C) 5 A
(D) 20 A

142. The direction of the magnetic field around a wire carrying a current, using the rules of conventional current flow, can be found with:
(A) the motor rule
(B) the right-hand rule
(C) The generator rule
(D) the left-hand rule

77.01.03.02

143. Electromagnetic induction is:
(A) the movement of electrons or current through a conductor
(B) the process by which magnetism is produced by an electric current flowing through a conductor
(C) the generation of emf caused by a difference in charge between two points
(D) the action which causes electron displacement in a conductor when lines of force move through it

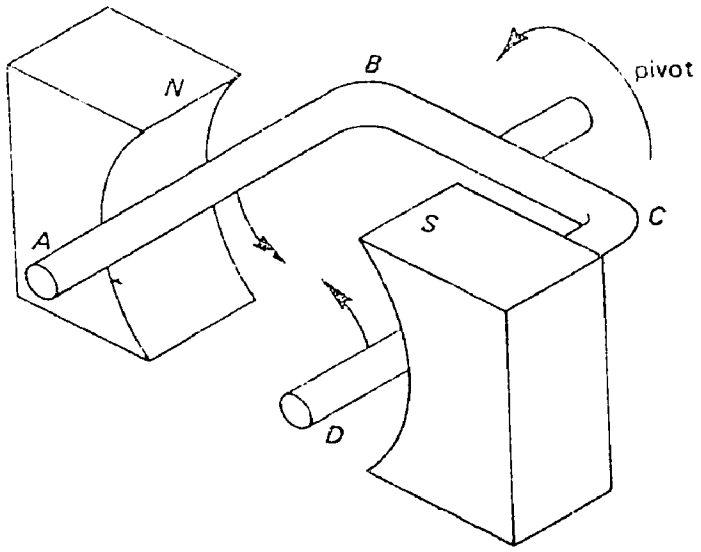
77.01.08.03 (continued)

144. One factor that determines the amount of induced emf is the:
(A) polarity of the magnet
(B) strength of magnetic field
(C) speed of relative motion of the magnetic field
(D) length of the magnetic field

145. Referring to the use of the left-hand rule for generators, which of the following indicates the field of flux?
(A) center finger
(B) thumb
(C) first finger
(D) hand

146. Electrons will flow from:

(A) A to B
(B) B to A
(C) C to B
(D) D to C



147. In any circuit a decrease in applied voltage will cause I_t to:

(A) increase.
(B) decrease.
(C) remain the same.
(D) go to zero.

77.01.08.04

148. Inductance is the property of a circuit that opposes any change in circuit:
(A) current
(B) length
(C) voltage
(D) polarity

149. What does a change in circuit current produce that opposes this change?
(A) change in polarity
(B) magnetic field
(C) positive change
(D) voltage

77.01.08.04 (continued)

150. Lenz's law is the basis for explaining the property of:
(A) series resistance
(B) current
(C) flux density
(D) inductance

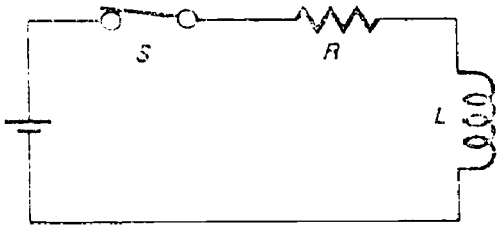
151. In parallel, total inductance is always:
(A) twice more than the smallest inductor
(B) more than the smallest inductor
(C) the same as the smallest inductor
(D) less than the smallest inductor

152. A parallel inductive circuit with one inductor of 100 mH and one of 25 mH would have an L_T of:
(A) 12.2 mH
(B) 17.5 mH
(C) 50 mH
(D) 7.2 mH

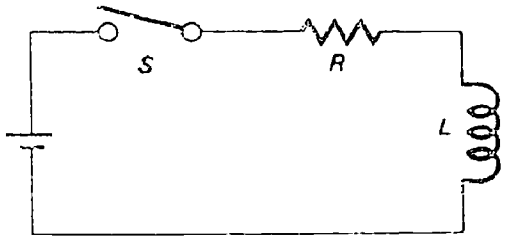
77.01.09.01

153. To increase induction between two coils:
(A) use low permeability core material
(B) decrease space between coils
(C) connect them
(D) decrease coil turns

154. Compare these two circuits. In which is inductance present?
(A) circuit a only
(B) both circuits
(C) neither circuit
(D) circuit b only



a



b

77.01.09.02

155. During current rise the polarity of the cemf always:
(A) reverses the source emf
(B) assists the source emf
(C) follows the source emf
(D) opposes the source emf

77.01.09.02 (contiuned)

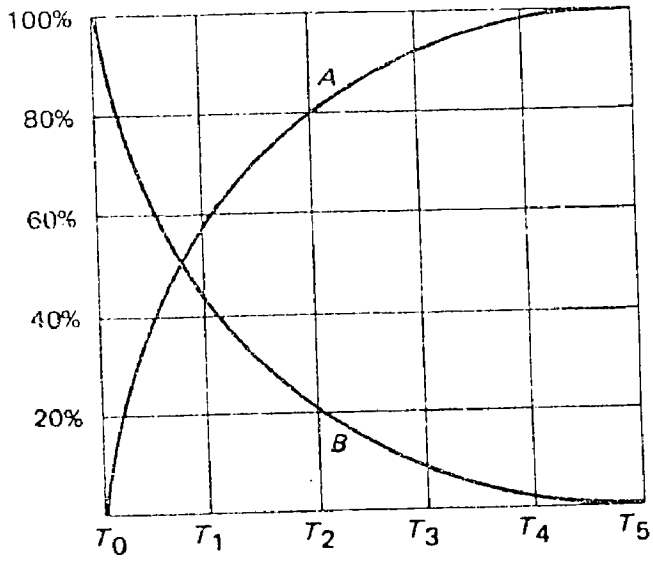
156. What values are represented by the graph below when a DC LR circuit is energized?

(A) V_R curve B; I curve B

(B) E_L curve A; V_R curve B

(C) V_R curve A; E_L curve B

(D) cemf curve A; I curve A



157. When an LR circuit is first energized, which of these quantities is maximum?

(A) voltage across resistor
(B) current
(C) cemf
(D) watts

77.01.09.03

158. A circuit time constant is determined by the formula:

(A) $TC = R + L$
(B) $TC = \frac{R}{L}$
(C) $TC = \frac{L}{R}$
(D) $TC = PL$

159. The greatest increase or decrease in current takes place during the:

(A) third TC
(B) second TC
(C) first TC
(D) fourth TC

160. For practical purposes five time contants are required to reach I_{max}.

(A) of equal time
(B) inversely proportional to cemf
(C) varied as current varies
(D) proportional to applied voltage

77.01.09.03 (continued)

161. The time constant of an LR circuit containing an inductor of 50 mH and a resistor of 5 K ohms is:
(A) 10 msec
(B) 0.01 sec
(C) 10 sec
(D) 10 usec

162. Which of the following combinations will have the greatest time constant?
(A) R = 50 ohms L = 500 mH
(B) R = 100 ohms L = 10 uH
(C) L = 100 mH R = 100 ohms
(D) L = 10 H R = 1 ohm

77.01.10.01

163. Two metal plates separated by a non-conductor is an example of a(n):
(A) inductor
(B) resistor
(C) capacitor
(D) generator

164. Energy is stored in a capacitor in the electrostatic field through the:
(A) dielectric
(B) plates
(C) conductors
(D) leads

165. Electrostatic lines of force:
(A) are invisible
(B) form closed loops
(C) are polarized from negative to positive
(D) move from North to South

166. When a capacitor is charged, the bound electrons in the dielectric:
(A) move from - to + charged plates
(B) have their orbits distorted
(C) move from + to - charged plates
(D) are not affected by the charged plates

167. The energy used to create an electrostatic field through the dielectric in a capacitor is recovered when:
(A) the capacitor charges
(B) the electrons are permitted to return to their normal positions on the plates
(C) current flows between the plates
(D) a voltage source is connected across the plates

77.01.10.02

168. The property of a circuit that opposes a change in voltage is called:
(A) capacitance
(B) resistance
(C) inductance
(D) current

77.01.10.02 (continued)

169. In a given capacitor, changing the dielectric to one that has a greater dielectric constant will have what effect on its capacitance?
(A) increase
(B) decrease
(C) no change
(D) decrease by one-half

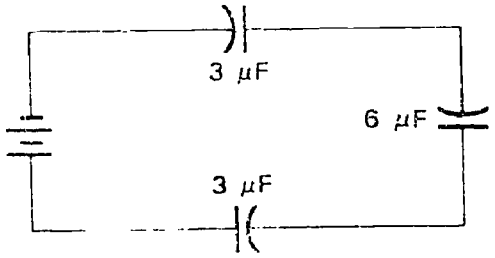
170. The capacitance of a capacitor is:
(A) directly proportional to the plate area
(B) inversely proportional to the plate area
(C) equal to the square of the plate area
(D) equal to the square root of the plate area

171 Since a capacitor reacts to a voltage change by producing a cemf, a capacitor is said to be:
(A) inductive
(B) reactive
(C) electromagnetic
(D) resistive

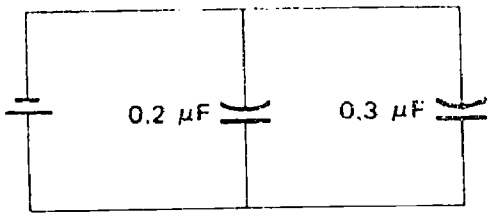
172. Polarity must be observed in the wiring connection of what kind of capacitors?
(A) trimmer
(B) ceramic
(C) electrolytic
(D) variable

77.01.10.03

173. The total capacitance in the cirucuit below is:
(A) 12 uF
(B) 1.2 uF
(C) 3 uF
(D) 0.3 uF

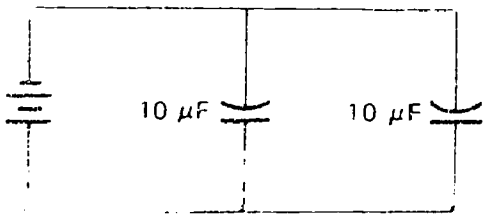


174. Determine the total capacitance in the circuit below:
(A) 1.0 uF
(B) 1.2 uF
(C) 6.0 uF
(D) 0.5 uF

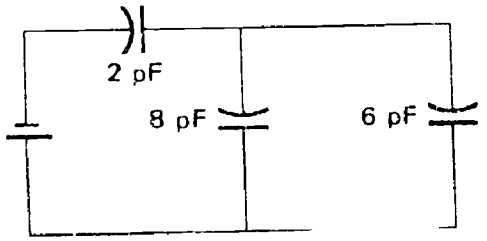


77.01.10.03

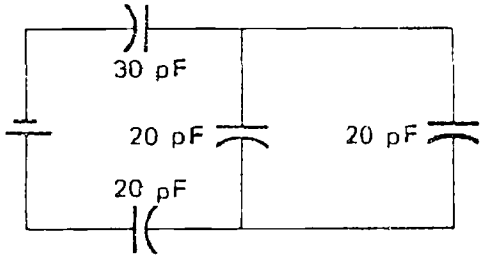
175. The total capacitance of the circuit below is:
(A) 0.5 uF
(B) 10 uF
(C) 5 uf
(D) 20 uF



176. What is the total capacitance of the circuit below?
(A) 4.67 pF
(B) 1.63 pF
(C) 11 pF
(D) 5 pF



177. What is the total capacitance of the circuit below?
(A) 90 pF
(B) 5.45 pF
(C) 9.23 pF
(D) 60 pF



77.01.10.04

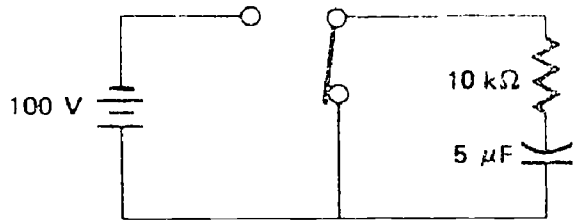
178. Displacement current is the current that flows in a capcitive circuit when the capacitor is:
(A) charging only
(B) both charging and discharging
(C) shorted
(D) discharging only

179. In a RC circuit, the capacitor requires an amount of time to become fully charged because the charging current is limited by:
(A) resistnace
(B) emf
(C) capacitance
(D) inductance

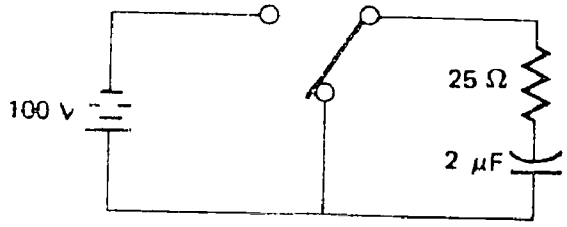
77.01.10.04 (continued)

180. If the resistance is doubled in a series RC circuit, the time constant will:
(A) decrease by 63.2% of its original value
(B) decrease by half
(C) decrease slowly
(D) double

181. Determine the value of voltage across the capacitor at the end of two time constants of discharge. The capacitor had 100 V across its plates when discharge started.
(A) 86.5 V
(B) 13.5 V
(C) 5.0 V
(D) 95.0 V



182. During discharge after 3 time constants, what is the value of current in the circuit below? The capacitor was fully charged before discharge started.
(A) 1.0 A
(B) 0.1 A
(C) 1.9 A
(D) 0.2 A



UNIT TEST ANSWER SHEET

Occupational Area: _____

File Code: 77.01.00.00 Answer Sheet

Name: _____

Family Pay Number: _____ Sex: M F (Circle 1)

ANSWERS

0701	1. D		21. A		41. B
	2. A		22. A		42. A
	3. D	0201	23. C	02	43. B
	4. C		24. B		44. A
	5. B		25. C		45. B
02	6. A		26. C		46. A
	7. B		27. D		47. A
	8. A	02	28. A	03	48. B
	9. B		29. D		49. D
	10. A		30. C		50. C
03	11. C		31. A		51. C
	12. A		32. A		52. D
	13. D	03	33. A	04	53. D
	14. C		34. D		54. D
	15. C		35. C		55. B
04	16. A		36. D		56. C
	17. D		37. B		57. B
05	18. A	0301	38. C	0401	58. A
	19. D		39. D		59. A
	20. C		40. A		60. A

UNIT TEST ANSWER SHEET

Occupational Area: _____
File Code: _____
Name: _____

ANSWERS

61.	D	81.	C	101.	A
62.	A	82.	C	102.	D
02 63.	B	03 83.	B	02 103.	A
64.	A	84.	C	104.	A
65.	D	85.	C	105.	C
66.	A	86.	C	106.	D
67.	A	87.	D	107.	B
03 68.	B	04 88.	B	03 108.	D
69.	D	89.	D	109.	A
70.	C	90.	A	110.	B
71.	B	91.	C	111.	D
72.	D	92.	B	112.	B
0501 73.	D	05 93.	C	04 113.	C
74.	C	94.	D	114.	D
75.	B	95.	D	115.	C
76.	D	96.	C	116.	B
77.	A	97.	C	117.	C
0278.	C	0601 98.	A	0701 118.	B
79.	D	99.	A	119.	B
80.	C	100.	B	120.	D

Occupational Area: _____
File Code: _____
Name: _____

ANSWERS

121.	C	141.	C	161.	D
122.	C	142.	D	162.	D
02 123.	D	03 143.	D	10.01 163.	C
124.	D	144.	B	164.	A
125.	B	145.	C	165.	A
128.	A	146.	A	166.	B
127.	D	147.	B	167.	B
03 128.	A	04 148.	A	02 168.	A
129.	C	149.	B	169.	A
130.	C	150.	D	170.	A
131.	C	151.	D	171.	B
132.	C	152.	D	172.	C
0501 133.	B	0901 153.	B	03 173.	B
134.	C	154.	B	174.	D
135.	A	02 155.	A	175.	D
136.	A	156.	C	176.	B
137.	A	157.	C	177.	C
02 138.	A	03 158.	C	04 178.	B
138.	C	159.	C	179.	A
140.	B	160.	A	180.	D

Occupational Area: _____
File Code: _____
Name: _____

ANSWERS

181. B	201. _____	221. _____
182. D	202. _____	222. _____
183. _____	203. _____	223. _____
184. _____	204. _____	224. _____
185. _____	205. _____	225. _____
186. _____	206. _____	226. _____
187. _____	207. _____	227. _____
188. _____	208. _____	228. _____
189. _____	209. _____	229. _____
190. _____	210. _____	230. _____
191. _____	211. _____	231. _____
192. _____	212. _____	232. _____
193. _____	213. _____	233. _____
194. _____	214. _____	234. _____
195. _____	215. _____	235. _____
196. _____	216. _____	236. _____
197. _____	217. _____	237. _____
198. _____	218. _____	238. _____
199. _____	219. _____	239. _____
200. _____	220. _____	240. _____

File Code: 77.01.01.00.A2-1

Date Published: 9/10/75

Mountain-Plains Education & Economic Development Program, Inc
Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: CURRENT

RATIONALE:

Current is a basic electrical property. Understanding current is essential to understanding direct current (DC) circuits.

PREREQUISITES:

Same as the Course (see Course LEG)

OBJECTIVES:

Given a student unit booklet, complete exercises about electrical current that enable you to identify and explain the theoretical characteristics of electricity (emphasizing current flow), use mathematics to determine current flow for direct current series circuits and identify the ammeter, its purpose and method of use.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 1: Current--, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

GENERAL INSTRUCTIONS:

You have been assigned into the first unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 The Electron
.02 Electron Movement
.03 Current Flow
.04 Measurement of Current
.05 The Ammeter

Principal Author(s): P. Hoggatt, L. Leland and B. Vetter

EVALUATION PROCEDURE:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

After completing this unit guide, begin with the first assigned Learning Activity Package (LAP).

File Code: 77.01.01.01.A2-0

Date Published: 9/10/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: The Electron

OBJECTIVES:

Give a diagram of an atom, label the components (electron, proton and neutron).

Explain the interrelationships of the components in an atom.

Recognize that matter varies by differing arrangements of the components in the atom.

EVALUATION PROCEDURE:

Student is to score at least 80% or the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 1: Current--), Trejo.

PROCEDURE:

1. Read pages 3-8 in Unit I, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.01.02.A2-0

Date Published: 9/10/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Electron Movement

OBJECTIVE:

Recognize a statement that explains the theory of electron movement.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 1: Current--), Trejo.

PROCEDURE:

1. Read pages 9-16 in Unit 1, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.01.03.A2-0

Date Published: 9/10/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Current Flow

OBJECTIVES:

Identify the methods of controlling the direction of electron drift.

Identify simple circuit schematics and symbols. (power, source, switch, load and conductor)

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 1, Current--), Trejo.

PROCEDURE:

1. Read pages 17-24 in Unit 1, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.01.04.A2-0

Date Published: 9/10/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Measurement of Current

OBJECTIVE:

Calculate the quantity of current flow in a given series direct current circuit.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 1: Current--), Trejo.

PROCEDURE:

1. Read pages 25-35 in Unit 1, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.01.05.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: The Ammeter

OBJECTIVE:

Recognize the procedures for the proper use of an ammeter.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 1: Current--, progress test), Trejo.

PROCEDURE:

1. Read pages 36-40 in Unit 1, DC Circuits.
2. Answer questions within the chapter.
3. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.02.00.A2-1

Date Published: 9/10/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: VOLTAGE

RATIONALE:

Voltage is a basic electrical property. This information is needed to understand direct current (DC) circuits.

PREREQUISITES:

Unit: Current

OBJECTIVES:

Given a student unit booklet, a student handbook, equipment and an experiment work station, complete exercises and prescribed experiments about measuring potential differences (voltage) that enable you to identify theoretical and practical characteristics of electromotive force (voltage), calculate voltage output for various sources, and identify the voltmeter, its purpose and method of use.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 2: Voltage--, student handbook, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

Equipment

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett, Sacramento, California.

Volt-ohmmeter
(3) 1.5 volt dry cells

GENERAL INSTRUCTIONS:

You have been prescribed into the second unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

Principal Author(s): P. Hoggatt, L. Leland and B. Vetter

PERFORMANCE ACTIVITIES:

.01 Electromotive Force and Voltage
.02 The Battery
.03 Measuring Voltage

EVALUATION PROCEDURES:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

This guide gives you an overview of the unit. Your instructor is available to answer questions you may have.

Please begin with the first assigned LAP in this unit.

File Code: 77.01.02.01.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Electromotive Force and Voltage

OBJECTIVES:

Identify terms, definition of terms, and symbols related to a difference of potential.

Mathematically expresses differences of potential.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 2: Voltage--), Trejo.

PROCEDURE:

1. Read pages 3-11 in Unit 2, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.02.02.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: The Battery

OBJECTIVES:

Identify the composition and characteristics of a dry cell battery.

Make applied voltage calculations for combinations of cells and batteries in given series and parallel circuits.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 2: Voltage--), Trejo.

PROCEDURE:

1. Read pages 12-18 in Unit 2, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.02.03.A2-0

Date Published: 9/11/75

Montana-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Measuring Voltage

OBJECTIVES:

Determine potential difference in given circuits.

Identify how to properly connect a voltmeter.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 2: Voltage--, student handbook, progress tests), Trejo.

Electricity/Electronics, "C" Cast-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett.

Volt-ohmmeter
1.5 volt dry cells

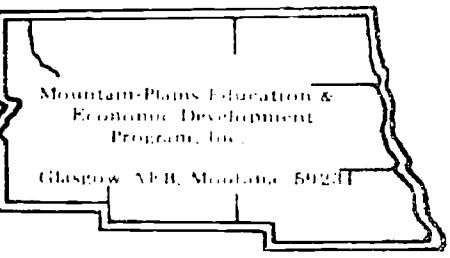
PROCEDURE:

1. Read pages 19-23 in Unit 2, DC Circuits.
2. Answer questions within the chapter.
3. Complete experiments 2, 3 and 4 in the student handbook.
4. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.03.00.A2-1

Date Published: 9/10/75



Learning Experience Guide

UNIT: RESISTANCE

RATIONALE:

Resistance is an electrical property. Current flow and electromotive force is essential to comprehend understanding the relationships between resistance, characteristics of direct current circuits.

PREREQUISITES:

Unit: Voltage

OBJECTIVES:

Given a student unit booklet, a student handbook, equipment and an experiment work station, complete exercises and prescribed experiments about resistors and resistance that enable you to identify and explain the theoretical and practical characteristics of resistance and resistors, calculate the resistance of electrical conductors, and identify the ohmmeter, its purpose and method of use.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 3: Resistance--, student handbook, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

Equipment

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett, Sacramento, California.

Volt-ohmmeter
(4) 1.5 volt cells

GENERAL INSTRUCTIONS:

You have been prescribed into the third unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

Principal Author(s): P. Hoggatt, L. Leland and B. Vetter

PERFORMANCE ACTIVITIES:

.01 Characteristics of Resistance
.02 Resistors
.03 Resistor Codes and Values
.04 The Ohmmeter

EVALUATION PROCEDURES:

The student takes a progress t[illegible] t[illegible] major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

After reading this guide, proceed to the first assigned LAP.

If you have any questions, consult with your instructor.

File Code: 77.01.03.01.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Characteristics of Resistance

OBJECTIVES:

Describe resistance, conductor and insulator.

Define the ohm.

Calculate the resistance of a conductor.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 3: Resistance--). Trejo.

PROCEDURE:

1. Read pages 3-12 in Unit 3, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.03.02.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Resistors

OBJECTIVES:

Identify the basic types of resistive material.

Describe types, functions, characteristics and structure of various resistors.

Identify schematic symbols for resistors.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 3: Resistance--), Trejo.

PROCEDURE:

1. Read pages 13-20 in Unit 3, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.03.03.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Resistor Codes and Values

OBJECTIVES:

Use the color and alpha-numeric code to encode and decode resistance values.

Identify the type of resistor given a drawing or schematic symbol.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 3: Resistance--), Trejo.

PROCEDURE:

1. Read pages 21-29 in Unit 3, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.03.04.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: The Ohmmeter

OBJECTIVES:

Identify the parts of an ohmmeter and their function.

Identify correctly connected multimeter given circuit diagrams.

Calculate specific resistance readings identified on given simple circuit diagrams.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 3: Resistance--, student handbook, progress test), Trejo.

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett.

Volt-ohmmeter
1.5 volt dry cells

PROCEDURE:

1. Read pages 30-39 in Unit 3, DC Circuits.
2. Answer questions within the chapter.
3. Complete experiment 5 in the student handbook.

   NOTE: See instructor for any questions or problems.

4. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.04.00.A2-1

Date Published. 9/10/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: MEASURING VOLTAGE AND CURRENT IN SERIES CIRCUITS

RATIONALE:

It is important that a service person interpret meter readings to determine if a circuit is operating according to specifications.

PREREQUISITES:

Unit: Voltage

OBJECTIVES:

Given a student unit booklet, a student handbook, equipment and an experiment station, complete exercises and prescribed experiments that enable you to identify and explain theoretical and practical characteristics of DC circuits.

Measure electrical current and voltage in direct current series circuits, using a multimeter.

RESOURCES:

Printed Material

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 4: Measuring Voltage and Current in Series Circuits--, student handbook, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

Equipment

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett, Sacramento, California.

Volt-ohmmeter
(4) 1.5 volt dry cells

GENERAL INSTRUCTIONS:

You have been prescribed into the fourth unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

PRINCIPAL AUTHOR(s): P. Hoggatt, L. Leland and B. Vetter

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit tests, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 Measuring Current in a Series Circuit
.02 Measuring Voltage in a Series Circuit
.03 Measuring DC Voltage with a Multimeter

EVALUATION PROCEDURE:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

Proceed to the first assigned LAP. Follow the directions given in the LAP. Your instructor will assist you if needed.

File Code: 77.01.04.01.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Measuring Current in a Series Circuit

OBJECTIVES:

Identify series circuit schematic diagrams.

Calculate the current flow at various points in a series circuit.

Identify the correct setting for the multimeter function and range switches for a given type of measurement.

Read current values from graphically presented multimeters.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 4: Measuring Voltage and Current in Series Circuits--), Trejo.

PROCEDURE:

1. Read pages 3-17 [illegible] Unit 4, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.04.02.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Measuring Voltage in a Series Circuit

OBJECTIVES:

Determine where voltage drops will occur in given series circuits.

Calculate voltage drop across identified elements in series circuits.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 4: Measuring Voltage and Current in Series Circuits--), Trejo.

PROCEDURE:

1. Read pages 18-26 in Unit 4, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.04.03.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Measuring DC Voltage with a Multimeter

OBJECTIVES:

Identify the procedures for connecting, using and reading a volt-ohmmeter.

Connect and use volt-ohmmeter to determine direct current voltages in given series circuits.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 4: Measuring Voltage and Current in Series Circuits--, student handbook, progress test), Trejo.

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett.

Volt-ohmmeter
1.5 volt dry cells

PROCEDURE.

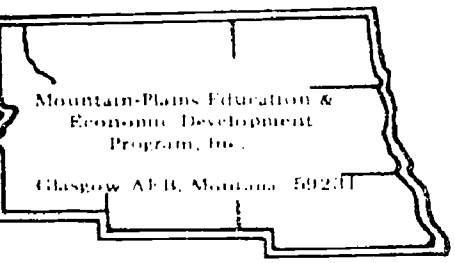
1. Read pages 27-39 in Unit 4, DC Circuits.
2. Answer questions within the chapter.
3. Complete experiment 6 in the student handbook.

   NOTE: See instructor for any questions or problems.
4. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.05.00.A2-1

Date Published: 9/10/75



Learning Experience Guide

UNIT: RELATIONSHIPS OF CURRENT, VOLTAGE AND RESISTANCE

RATIONALE:

Knowledge about the effects of changing electrical properties and their relationships in circuits will provide logic for troubleshooting and circuit diagnosis.

PREREQUISITES:

Unit: Measuring Voltage and Current In Series Circuits

OBJECTIVES:

Given a student unit booklet, a student handbook, equipment an an experiment station, complete exercises and prescribed experiments that enable you to identify and explain relationships of voltage, current, resistance and power, using the power formula and Ohm's Law; calculate electrical power; and use the comparison table and multimeter troubleshooting methods for direct current series circuits.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 5: Relationships of Current, Voltage and Resistance--, student handbook, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

Equipment

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett, Sacramento, California.

Regulated power supply
Volt-ohmmeter

GENERAL INSTRUCTIONS:

You have been prescribed into the fifth unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

Principal Author(s): P. Hoggatt, L. Leland and B. Vetter

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 Relationship of Current to Voltage and Resistance
.02 The Ohm's Law Formula
.03 Power
.04 Internal Resistance
.05 Troubleshooting Series Circuits

EVALUATION PROCEDURES:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

If you now have any questions, consult your instructor. Otherwise, you should proceed to the first assigned LAP.

File Code: 77.01.05.01.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Relationship of Current to Voltage and Resistance

OBJECTIVES:

Identify the proportional relationship of voltage, resistance and current and write this as a mathematical equation.

Use the proportional relationships to determine how a change in one electrical property affect the others (voltage, resistance or current).

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 5: Relationships of Current, Voltage and Resistance--), Trejo.

PROCEDURE:

1. Read pages 3-9 in Unit 5, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.05.02.A2-0

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Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: The Ohm's Law Formula

OBJECTIVES:

State the Ohm's Law and write it as a mathematical formula.

Calculate the unknown values of either voltage, resistance or current using the Ohm's Law Formula when given series circuit schematic drawings.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 5: Relationships of Current, Voltage and Resistance--), Trejo.

PROCEDURE:

1. Read pages 1-23 in Unit 5, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.05.03.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Power

OBJECTIVES:

Define electrical power and write the mathematical formula for electrical power.

Calculate the unknown values of either electrical power, resistance, voltage or current using the electrical power formulas and Ohm's Law when given series circuit schematic diagrams.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 5: Relationships of Current, Voltage and Resistance--), Trejo.

PROCEDURE:

1. Read pages 24-32 in Unit 5, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.05.04.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Internal Resistance

OBJECTIVES:

Identify the symbol for internal resistance.

Identify the effect of, state how to determine and calculate the internal resistance for given series circuits.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 5: Relationships of current, Voltage and Resistance--), Trejo.

PROCEDURE:

1. Read pages 33-38 in Unit 5, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.05.05.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Troubleshooting Series Circuits

OBJECTIVES:

Complete comparison tables for given series circuits.

Use comparison tables to identify circuits problems.

Identify the function of a series circuit protective device.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 5: Relationships of Current, Voltage and Resistance--, student handbook, progress test), Trejo.

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett.

Volt-ohmmeter
Regulated power supply

PROCEDURE:

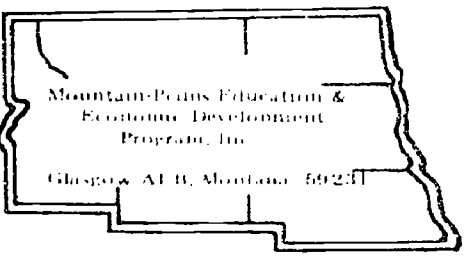
1. Read pages 39-47 in Unit 5, DC Circuits.
2. Answer questions within the chapter.
3. Complete experiment 7 in the student handbook.

   NOTE: See instructor for any questions or problems.
4. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.06.00.A2-1

Date Published: 9/10/75



Learning Experience Guide

UNIT: PARALLEL CIRCUITS

RATIONALE:

Understanding the concept and use of parallel circuits is vital to a repairman because parallel circuits are used in electronic devices.

PREREQUISITES:

Unit: Relationships of Current, Voltage and Resistance

OBJECTIVES:

Given a student unit booklet, complete exercises that identify and explain relationships of current, power, resistance and voltage.

Use the power formula and Kirchhoff's Law to calculate electrical power.

Use a troubleshooting table.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 6: Parallel Circuits--, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

GENERAL INSTRUCTIONS:

You have been prescribed into the sixth unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

Principal Author(s): P. Hoggatt, L. Leland and B. Vetter

PERFORMANCE ACTIVITIES:

.01 Voltage and Current
.02 Resistance and Power
.03 Troubleshooting Parallel Circuits
.04 Variational Analysis

EVALUATION PROCEDURE:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

If you have questions about this unit, consult with the instructor. Obtain the first assigned LAP in this unit and follow the directions given.

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Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Voltage and Current

OBJECTIVES:

Identify the general characteristics of parallel circuits.

Identify and use Kirchhoff's Voltage and Current Laws for DC Parallel Circuits.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 6: Parallel Circuits--), Trejo.

PROCEDURE:

1. Read pages 3-9 in Unit 6, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.06.02.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Resistance and Power

OBJECTIVES:

Given schematic diagrams of parallel circuits with identified circuit properties, compute resistance and power at various points in the circuits and total circuit resistance and power.

Given various schematic diagrams determine which circuits are electrically equivalent.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 6: Parallel Circuits--), Trejo.

PROCEDURE:

1. Read pages 10-24 in Unit 6, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.06.03.A2-0

Date Published: 9/11/75

Mountain Plains Education & Economic Development Program, Inc.
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Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Troubleshooting Parallel Circuits

OBJECTIVES:

Determine the effect an open and short has on a given parallel direct current circuit.

Calculate various unknowns (voltage, current, power and resistance) for given parallel direct current circuits.

EVALUATION PROCDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 6: Parallel Circuits--), Trejo.

PROCEDURE:

1. Read pages 25-30 in Unit 6, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to LAP.

Principal Author(s): P. Schuster, B. Vetter

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Mountain-Plains Education & Economic Development Program, Inc.
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Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Variational Analysis

OBJECTIVES:

Identify and describe dependent and independent variables in a parallel direct current circuit.

Complete a variational analysis table for a given parallel circuit that shows the effect of current, power, voltage drops and total resistance when varying the applied voltage or resistance.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 6: Parallel Circuits--, progress tests), Trejo.

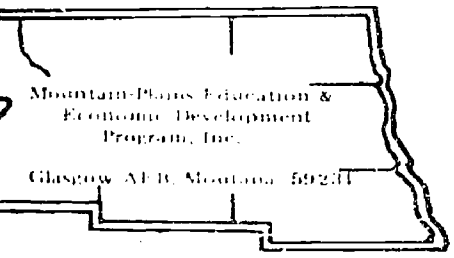
PROCEDURE:

1. Read pages 31-38 in Unit 6, DC Circuits.
2. Answer questions within the chapter.
3. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.07.00.A2-1

Date Published: 9/10/75



Learning Experience Guide

UNIT: SERIES-PARALLEL CIRCUITS

RATIONALE:

Most circuits are a combination of series and parallel circuits. This unit will explain the combined operational relationship.

PREREQUISITES:

Unit: Parallel Circuits

OBJECTIVES:

Given a student unit booklet, complete exercises that identify and explain the relationships of voltage and resistance in complex (series-parallel) direct current circuits; and identify voltage divider, its purpose and operational characteristics.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 7: Series-Parallel Circuits--, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

GENERAL INSTRUCTIONS:

You have been prescribed into the seventh unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 Complex Circuits
.02 Voltage Reference
.03 Voltage Dividers

EVALUATION PROCEDURE:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

After completing this guide, start with the first assigned LAP. Your instructor will help you with any questions.

File Code: 77.01.07.01.A2-0

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Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Complex Circuits

OBJECTIVES:

Given a schematic of various series parallel circuits, redraw into simplified circuit diagrams.

Determine the values needed to complete an analysis table. (This table should include resistance, current, voltage and power ratings in total and at various points in circuits.)

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 7: Series-Parallel Circuits--), Trejo.

PROCEDURE:

1. Read pages 3-14 in Unit 7, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

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Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Voltage Reference

OBJECTIVES:

Identify the schematic symbol for a grounded connection.

Explain the effects of a grounded connection at various points in a direct current circuit.

Calculate and record voltages with respect to ground.

Identify where a ground connection should be made to obtain a negative voltage.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 7: Series Parallel Circuits--), Trejo.

PROCEDURE:

1. Read pages 15-24 in Unit 7, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.07.03.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Voltage Dividers

OBJECTIVES:

Identify a bleeder resistor.

Calculate and record the missing information to make a correct circuit when given an incomplete schematic of a voltage divider network.

Calculate current flow through a bleeder resistor under stated conditions.

Draw the schematic diagram of a voltage divider for given design conditions.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 7: Series-Parallel Circuits--, progress test), Trejo.

PROCEDURE:

1. Read pages 25-27 in Unit 7, DC Circuits.
2. Answer questions within the chapter.
3. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

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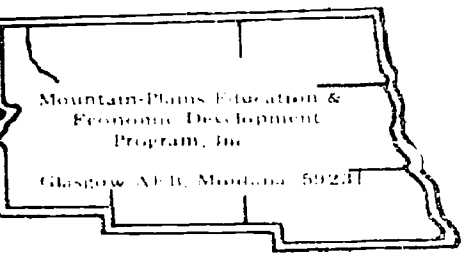

Learning Experience Guide

UNIT: MAGNETISM AND ELECTROMAGNETICS

RATIONALE:

The principles of magnetism and electromagnetics are basic to understanding electrical devices. Many circuit components use electromagnetism to function.

PREREQUISITES:

Unit: Series-Parallel Circuits

OBJECTIVES:

Given a student unit booklet, complete exercises that identify and explain the theoretical and practical characteristics of magnetism and induction in direct current electrical/electronic circuits.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 8: Magnetism and Electromagnetics--, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

GENERAL INFORMATION:

You have been prescribed into the eighth unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITIES:

.01 Magnetism
.02 Electromagnetism
.03 Electromagnetic Induction
.04 Induction, Inductance and Inductors

Principal Author(s); P. Hoggatt, L. Leland and B. Vetter

EVALUATION PROCEDURE:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

You are now in the eight unit of the D. C. Circuits Course. There are four LAPs in this unit.

Begin the next assigned LAP.

File Code. 77.01.08.01.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Magnetism

OBJECTIVES:

Identify characteristics of magnetism.

Identify and define terms used to describe magnetism.

Explain magnetic field characteristics and the effect of shielding.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 8: Magnetism and Electromagnetics--), Trejo.

PROCEDURE:

1. Read pages 3-13 in Unit 8, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.08.02.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Electromagnetism

OBJECTIVES:

Explain characteristics of electromagnetism.

Explain and use the Left Hand Rule for Conductors and Coils.

Identify types and functions of relays and solonoids.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 8: Magnetism and Electromagnetics--), Trejo.

PROCEDURE:

1. Read pages 14-22 in Unit 8, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.08.03.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Electromagnetic Induction

OBJECTIVES:

Identify and define terms used to describe induction.

Explain and use the Left Hand Rule for Generators.

State three conditions required for electromagnetic induction.

Describe counter electromotive force.

Describe and apply Lenz's Law.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 8: Magnetism and Electromagnetics--), Trejo.

PROCEDURE:

1. Read pages 23-37 in Unit 8, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.08.04.A2-0

Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
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Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Induction, Inductance and Inductors

OBJECTIVES:

Describe the characteristics of flux density.

Describe the factors that determine inductance and induction in a coil.

Explain the differences between induction and inductance.

Determine the amount of inductance in a circuit from a given schematic diagram.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 8: Magnetism and Electromagnetics--, progress test), Trejo.

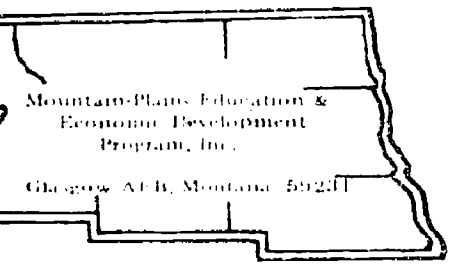
PROCEDURE:

1. Read pages 38-48 in Unit 8, DC Circuits.
2. Answer questions within the chapter.
3. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.09.00.A2-1

Date Published: 9/10/75



Learning Experience Guide

UNIT: MUTUAL INDUCTION AND RL CIRCUITS

RATIONALE:

An understanding of mutual induction, RL circuits and time constants is stressed in this unit. This information will help you understand how electrical power is distributed within the circuit. Effectiveness in troubleshooting is increased when applying this information.

PREREQUISITES:

Unit: Magnetism and Electromagnetics

OBJECTIVES:

Given a student unit booklet, complete exercises that identify, explain and mathematically determine the effect that inductance, voltage and resistance have on induction and RL time constant in electrical/electronic direct current circuits.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 9: Mutual Induction and RL Circuits--, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

GENERAL INSTRUCTIONS:

You have been prescribed into the ninth unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing. After successful completion of the unit test, the next assigned unit for the course is begun.

PERFORMANCE ACTIVITES:

.01 Mutual Induction
.02 RL Circuits
.03 RL Time Constant

Principal Author(s): P. Hoggatt, L. Leland and B. Vetter

EVALUATION PROCEDURE:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

Go to the first assigned LAP for this unit.

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Date Published: 9/11/75

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Mutual Induction

OBJECTIVES:

Identify the polarity of a series DC circuit the instant the switch is closed.

Given sets of schematic symbols for coils, determine which have the greatest mutual inductance.

Determine the total inductance of a circuit that contains either aiding or opposing coils.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 9: Mutual Induction and RL Circuits--), Trejo.

PROCEDURE:

1. Read pages 3-14 in Unit 9, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.09.02.A2-0

Date Published: 9/11/75

Montana Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: RL Circuits

OBJECTIVES:

Identify the characteristics of a RL series circuit.

Given a circuit time decay graph, determine the voltage and current for the inductor and resistor at various times.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 9: Mutual Induction and RL Circuits--), Trejo.

PROCEDURE:

1. Read pages 15-22 in Unit 9, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.09.03.A2-0

Date Published: 9/11/75

Montana Plans Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: RL Time Constant

OBJECTIVES:

Identify and use the resistive inductance RL formula for determing time constant.

Given series RL circuits and a universal time constant chart, compute time constants, voltages, currents and resistance at various times.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 9: Mutual Induction and RL Circuits--, progress test), Trejo.

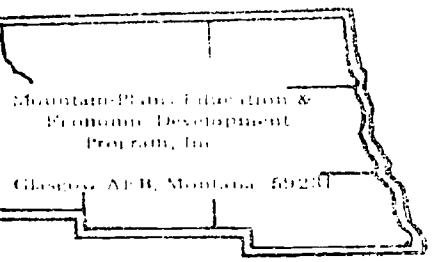
PROCEDURE:

1. Read pages 23-38 in Unit 9, DC Circuits.
2. Answer questions within the chapter.
3. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter

File Code: 77.01.10.00.A2-1

Date Published: 9/10/75



Learning Experience Guide

UNIT: CAPACITANCE

RATIONALE:

Capacitors are basic electronic circuit components. Capacitance is a circuit property. Understanding the property of capacitance will then help you to diagnose and troubleshoot correctly.

PREREQUISITES:

Unit: Mutual Induction and RL Circuits

OBJECTIVES:

Given a student unit booklet, a student handbook, equipment and an experiment station, complete exercises and prescribed experiments that enable you to identify, explain and mathematically determine the effect that capacity, voltage and resistance have on capacitance and RC time constant in electrical/electronic direct current circuits.

RESOURCES:

Printed Materials

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 10: Capacitance--, student handbook, progress tests). Paul E. Trejo, Westinghouse Learning Corporation, New York, New York, 1972.

Equipment

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett, Sacramento, California.

Vacuum tube volt meter
Regulated power supply
Stop watch

GENERAL INSTRUCTIONS:

You have been prescribed into the tenth unit of this course. The activities that you perform will be assigned one at a time. A LAP will give you directions for each activity. Read the LAP and follow the procedure and directions given.

Principal Author(s): P. Hoggatt, L. Leland and B. Vetter

When you finish the performance activities for the unit, you will be given a unit test as stated in the "Evaluation Procedures" for post testing.

PERFORMANCE ACTIVITIES:

.01 The Capacitor
.02 Capacitance
.03 Capacitance Calculations
.04 RC Time Constant

EVALUATION PROCEDURES:

The student takes a progress test about the major concepts and procedures presented in the unit activities.

Successful completion is correctly answering at least 80% of the test items.

FOLLOW-THROUGH:

This is the final unit in the D.C. Circuits Course. This course will be the basis for future application. Please start the first assigned LAP.

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Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: The Capacitor

OBJECTIVES:

Identify types of capacitors and their internal structure.

Identify the function of a capacitor in a series DC circuit.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 10: Capacitiance--), Trejo.

PROCEDURE:

1. Read pages 3-16 in Unit 10, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

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Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Capacitance

OBJECTIVES:

Given a pictorial of the plates of several capacitors, determine which as the greater capacitance.

Identify and use the unit and symbol for capacitance.

Identify conditions in a series D.C. circuit that will increase the capacitance of the circuit.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 10: Capacitance--), Trejo.

PROCEDURE:

1. Read pages 17-21 in Unit 10, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

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Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: Capacitance Calculations

OBJECTIVE:

Calculate the total capacitance of a series D.C. circuit.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 10: Capacitance--), Trejo.

PROCEDURE:

1. Read pages 22-27 in Unit 10, DC Circuits.
2. Answer questions within the chapter.
3. Proceed to next LAP.

Principal Author(s): P. Schuster, B. Vetter

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Glasgow AFB, Montana 59231

Learning Activity Package

Student: _____

Date: _____

PERFORMANCE ACTIVITY: RC Time Constant

OBJECTIVES:

Calculate values for voltage, current and voltage drops at various times during charging or discharging of a capacitor in a series D.C. circuit.

Identify the effect on the RC time constant of a series circuit when the resistance, capacitance or voltage is increased.

Identify zero or maximum values for current, voltage and voltage drops of a charged capacitor in a series circuit.

EVALUATION PROCEDURE:

Student is to score at least 80% on the unit test for questions pertaining to this performance activity.

RESOURCES:

DC Circuits, An Individualized Approach to Electronics (booklet--Unit 10: Capacitance--student handbook, progress test), Trejo.

Electricity/Electronics, "C" Case-Combination Learning Unit - Portable, Model BG850A/C, Brodhead-Garrett.

Vacuum tube voltmeter
Regulated power supply
Stop watch

PROCEDURE:

1. Read pages 28-38 in Unit 10, DC Circuits.
2. Answer questions within the chapter.
3. Complete experiement 8 in the student handbook.

   NOTE: See instructor for any questions or problems.

4. Take the unit progress test.

Principal Author(s): P. Schuster, B. Vetter